Chapter 5
Environmental Impacts and Mitigation Measures

5.1 Overview

Chapter 5 presents the environmental analysis of the program alternatives. As the Central Valley Water Board has not identified a preferred alternative, all five alternatives are discussed in an equal level of detail within each resource section. Following the analysis of impacts, suggested mitigation is delineated.

5.1.1 Approach to Impacts

The ILRP alternatives vary widely in monitoring requirements, lead entities, and other regulatory elements. This environmental analysis attempts to relate those regulatory distinctions to changes in the physical environment of irrigated lands that may result from implementation of an ILRP alternative. To do so, the resource analysts evaluated the possible impacts of several management practices described in the ECR and quantified by alternative in the Draft ILRP Economics Report (ICF International 2010). As is appropriate within a PEIR, the impacts identified are described generally and are not associated with a specific impact location.

The management practices analyzed, as shown in Table 5.1-1, are not a mandatory part of any alternative, but are identified in the Draft ILRP Economics Report as common practices implemented to meet water quality and other farm management goals on irrigated lands. The analyzed management practices are a sample of those most likely to cause an environmental and economic impact. However, it is foreseeable and expected that growers will choose from among the many available management practices to meet water quality goals; some practices may be inappropriate to some crop types, soil conditions, or other considerations. Most identified potential impacts are indirect and can be avoided by use of alternate practices. Where no alternate practice exists, growers who choose to use these practices can avoid impacts to sensitive resources by following the mitigation measures identified in each resource section.

Table 5.1-1. Management Practices Analyzed for ILRP Alternatives

Practice	Description
Nutrient management	Reduced application amounts and frequency and nutrient budgeting for fertilizers. No new hardware required and no ground-disturbing likely to result. Practice reduces soluble and/or insoluble constituents moving to water bodies.
Improved water management	Improved management of irrigation water application (reduced over-application) and use of water additives to coagulate particles. Results in reduced sediment runoff, less deep percolation to groundwater. No new hardware required and no ground-disturbing activities likely to result.
Tailwater recovery system	Use of tailwater pond to collect surface runoff and prevent flow of sediment and other constituents of concern (COCs); reduces volume of water moving to receiving surface water or groundwater. Includes significant construction effort: construction of ponds, and installation and operation of pumps, often diesel, to recirculate runoff over fields.

Practice	Description
Pressurized irrigation	Conversion from surface to pressurized irrigation. Reduces volume of water moving to receiving surface water or groundwater, thereby reducing flow of sediment and other COCs to those waters. Fieldwork involved in setting up new irrigation system does not substantially exceed usual field preparation activities.
Sediment trap, hedgerow, or buffer	Sediment trap or physical barrier to reroute or capture sediment or reroute water. Water is diverted to allow sediment to settle out before water enters receiving water. Does not reduce overall surface flow or groundwater percolation. Fieldwork involved in creating traps, hedgerows, or buffers does not substantially exceed usual field preparation activities.
Cover cropping or conservation tillage	Use of secondary crop to reduce exposed dirt. Reduces sediment movement and increases infiltration rate of water and nutrients to root zone. Reduces use of nutrients and reduces runoff of sediment and other COCs to receiving surface water. Increases percolation, could negatively impact groundwater without proper nutrient and chemical management.
Wellhead protection	Physical barrier that prevents contaminated surface water from entering groundwater through well shaft. Berms are constructed around wells to prevent runoff from entering, or unused wells are capped with metal welded plates. Minor implementation effort; dirt berm or cover installation does not substantially exceed usual field preparation activities.

Note: A more in-depth description of these management practices is available in the *Existing Conditions Report* (ICF Jones & Stokes 2008).

5.1.2 Significance Determinations and Mitigation

Implementation of program alternatives has been determined to result in potentially significant impacts for several resources. Such impacts are largely limited to locations where implementation of management practices has the potential to affect sensitive resources. While these practices are not mandated by the Central Valley Water Board as an element of any alternative, they represent common ways to achieve water quality goals by the regulated community. As such, it is assumed that such practices will be implemented, although the location of such implementation and the likelihood of resulting impacts are unknown at this time. The chosen ILRP enforcement mechanism will include project-level mitigation measures that provide a greater level of specificity in the avoidance of environmental impacts.

5.2 Consistency with Plans and Policies

CEQA Guidelines Section 15125(d) requires an EIR to discuss any inconsistencies between the proposed project and applicable general plans and regional plans. Relevant applicable plans are discussed within each resource section. Consistency of the ILRP with applicable legal and regulatory requirements, as well as other regulatory programs, is discussed in the Staff Report (CalEPA and Central Valley Water Board 2010), appended hereto as Appendix A.

Section 5.3
Cultural Resources

5.3.1 Introduction

This section describes the cultural resources setting of the program area. *Cultural resource* is the term used to describe several different types of resources, including archaeological, architectural (built environment), and traditional cultural properties. Archaeological sites include both prehistoric and historic deposits. Built environment properties include buildings, bridges, and infrastructure. Traditional cultural properties (TCPs) include those locations of importance to a particular group.

A brief prehistoric and historical background discussion is provided to better understand the context of the cultural resources associated with the program area. The federal and state regulations that apply to cultural resources in the program area are described for the purpose of analyzing potential program impacts. Finally, the chapter identifies potential impacts on cultural resources that may result from implementation of program alternatives, as well as mitigation measures to avoid or reduce potentially significant impacts.

All identified cultural resource impacts would result from the implementation of ground-disturbing management practices by growers in response to increased regulation. However, the program alternatives would not directly physically disturb any cultural resources in the program area. Management practices, which vary in terms of their physical footprint and location, could be implemented in some or all of 36 affected Central Valley counties. The establishment of a policy over the vast program area—without surveyable management practice footprints—is not amenable to a typical CEQA analysis for cultural resources. Consequently, a programmatic approach was deemed an appropriate level of analysis. No on the ground field surveys were conducted in preparation of this document.

5.3.2 Regulatory Framework

The following federal and state laws and policies are relevant to cultural resources in the program area.

Federal

As presently formulated, the program alternatives are not subject to federal cultural resources regulations. Should the Central Valley Water Board redesign the program in such a way that funding, permits, or approval from federal sources is required, the program would become subject to federal cultural resources regulations. Such regulations could include Section 106 of the National Historic Preservation Act (NHPA), the American Indian Religious Freedom Act, and executive orders concerning cultural resources management.

State

Actions that require funding, approval, or permits from a state agency, such as the program alternatives, are subject to CEQA. The CEQA statutes and State CEQA Guidelines require that agencies responsible for funding, permitting, or approving projects assess the potential impacts of the project on the environment, including cultural resources. Under CEQA, *cultural resources* are defined as districts, buildings, sites, structures, or objects, each of which may have historic, architectural, archaeological, cultural, or scientific importance. Under the State CEQA statutes, an impact on a cultural resource is considered significant if a project would result in an effect that may change the significance of the resource (PRC Section 21084.1). Demolition, replacement, substantial alteration, and relocation of historic properties are actions that would change the significance of a historic resource (14 CCR Section 15064.5). Before the level of significance of impacts can be determined and appropriate mitigation measures developed, the significance of cultural resources must be determined. The following steps are normally taken in a cultural resources investigation to comply with CEQA:

1. Identify cultural resources.
2. Evaluate the significance of the cultural resources based on established thresholds of significance.
3. Evaluate the effects of a project on all cultural resources.
4. Develop and implement measures to mitigate the effects of the project on significant cultural resources.

The State CEQA Guidelines define three ways that a cultural resource may qualify as an historical resource for the purposes of CEQA review.

1. The resource is listed in or determined eligible for listing in the California Register of Historical Resources (CRHR).
2. The resource is included in a local register of historical resources, as defined in PRC Section 5020.1(k), or is identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g) unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
3. The lead agency determines the resource to be significant as supported by substantial evidence in light of the whole record (14 CCR Section 15064.5[a]).

A cultural resource may be eligible for inclusion in the CRHR if:

1. It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
2. It is associated with the lives of persons important in our past.
3. It embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values.
4. It has yielded, or may be likely to yield, information important in prehistory or history.

In addition, CEQA distinguishes between two classes of archaeological resources: archaeological resources that meet the definition of an historical resource as above, and unique archaeological resources. An archaeological resource is considered unique if:

- It is associated with an event or person of recognized significance in California or American history or of recognized scientific importance in prehistory.
- It can provide information that is of demonstrable public interest and is useful in addressing scientifically consequential and reasonable research questions.
- It has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind. (PRC Section 21083.2.)

5.3.3 Environmental Setting

The Central Valley is comprised of three major basins regions, including the Sacramento Valley Basin, the San Joaquin Valley Basin, and the Tulare Lake Basin, which extend in a north-to-south direction through the center of the state. The three basins encompass all or portions of 36 affected counties.

Archaeological Setting

The Central Valley Region

The prehistory of the study area is complex, with distinct regional patterns that extend back more than 11,000 years. Due to the variability and complexity of the archaeological record, different chronologies and culture histories are associated with specific geomorphic provinces of California. The distinct geology, hydrology, and landform of each province provided the inhabitants of the area with different resources. Consequently, variations in the archaeological record point to variations in lifestyles regarding subsistence strategy, ceremonial and religious beliefs, social organization, housing, and material culture.

The study area encompasses lands occupied by more than 20 distinct Native American cultural groups. Although most California tribes shared similar elements of social organization and material culture, anthropologists used linguistic affiliation as the principal means of establishing territorial boundaries of California Indians. Prior to European settlement of California, an estimated 310,000 native Californians spoke dialects of as many as 80 mutually unintelligible languages representing six major North American linguistic stocks (Cook 1978:91; Shipley 1978:80–90).

Sacramento Valley Basin

Archaeology

The southern half of the Sacramento Valley Basin is better known than the northern half, while variations also exist between the west and east side. The oldest archaeological materials identified in the Sacramento Valley Basin are fluted stone projectile points ascribed to the Paleo-Indian Period of California (12,000–10,000 B.P.[1]). Only about 20 such artifacts have been identified in the Sacramento Valley Basin, and association with other types of artifacts is ambiguous, such that little is known of the Paleo-Indian occupation of the basin. (Dillon 2002:112, Table 1, Figure 5.)

[1] B.P. denotes years before the present day, which is conventionally held to be A.D. 1950.

Alternatively, the southern half of the Sacramento Valley Basin is known to be a cultural complex that spans 8,000 B.P. to 10,000 B.P. It is characterized by stemmed projectile points and large basalt cores evident in the northernmost portion of the study area, indicating a shift in hunting technology. Approximately 8,000 years ago, many California cultures shifted the main focus of their subsistence strategies from primarily hunting to seed gathering. This period spans from ca. 8,000 to 3,000 B.P. and is characterized by a more diversified collection of artifacts, including fishing-related and food-grinding implements as well as a diverse collection of projectile points types and sizes. The period from 3,000 B.P. to the 18th and 19th centuries is better known in the archaeological record; it reflects a particularly specialized adaptation to locally available resources and intensification in subsistence strategy. This phase is characterized by smaller projectile points, bedrock mortars, pestles, and an expansion in the exchange system. Primarily within the last 1,000 years, the archaeological record also indicates a trend toward a more sedentary lifestyle as the population expanded.

The Sacramento Valley Basin is rich in prehistoric-period resources. More than 11,500 prehistoric archaeological sites and more than 800 multicomponent sites have been recorded within the Sacramento Valley Basin (Table 5.3-1). Of particular importance are the large, deep midden sites, which provide information on prehistoric culture extending over thousands of years. In the foothills, middens, lithic scatters, and bedrock mortars predominate. Prehistoric sites include milling stations, lithic scatters, habitation sites, artifact scatters, rock circles, burials, quarries, and animal kill sites (USBR 1996:II-18, II-22–24).

Ethnography

The study area encompasses the territory of 12 California Indian groups that have been divided by anthropologists based on perceived linguistic similarities. The Sacramento Valley Basin includes territories occupied or partially occupied by the following groups: Maidu, Konkow, Nisenan, Yana, Wintu, Nomlaki, Patwin, Wappo, Achumawi, Atsugewi, Shasta, and Pomo (Heizer 1978:ix). All native Californians followed a basic hunter-gatherer lifestyle subsisting through a seasonal round of plant collecting, hunting, and fishing, and living in tribelets or semi-permanent villages. Important food sources were buckeye, seeds, bulbs, pine nuts, deer, elk, rabbits, squirrels, fowl, salmon and other fish, bear, and insects. Most groups followed an egalitarian system with a headman or woman who would speak for the tribe or help resolve conflicts. The headman position could be chosen or inherited, depending on the Indian group concerned. Intermarriage and/or conflict was common among neighboring groups. Religious practices differed from group to group with underlying similarities like the role of shamans and healers.

San Joaquin Valley Basin

Archaeology

The cultural chronology of the San Joaquin Valley Basin is similar to that of the Sacramento Valley Basin. All native Californians followed a basic hunter-gatherer lifestyle subsisting through a seasonal round of plant collecting, hunting, and fishing. Chronological and cultural-historical distinctions are based on varied technological markers, such as projectile point types, shell ornaments, burial practices, and an introduction of ceramic and steatite (soapstone) industries. The valley floor of this region contains many of the same type of prehistoric resources found in the Sacramento Valley Basin. The variations between the east and west portions of the area, including artifact types and materials, are related to the different ecological opportunities present in lowland and upland settings. The region is rich in archaeological sites, with more than 10,900 prehistoric archaeological sites and more than 700 multicomponent sites (sites with prehistoric and historic-period materials) recorded in the area (Table 5.3-1). Prehistoric site types include occupation sites with midden and house pits, temporary camps, milling stations, intaglios[2], rock shelter sites, cemetery and single burials, lithic scatters, tool scatters, quarries, pictographs and petroglyphs, trails, and rock cairns. (USBR 1996:II-39)

Ethnography

The program study area encompasses four linguistically distinctive cultural groups. The San Joaquin Valley Basin includes territories occupied or partially occupied by the following groups: the Yokuts, Miwok, Costanoan, and Monache (Heizer 1978:ix; Milliken 1994:165, Figure 5.1; Milliken 1995:Map 2). In general, these groups were seasonally mobile hunter-gatherers with semipermanent villages. With access to the higher elevation of the foothills, acorns were the staple food resource among all the groups. Other important food sources were buckeye, seeds, bulbs, pine nuts, deer, elk, rabbits, squirrels, fowl, salmon and other fish, bear, and insects. Trade and marriage were common among the three groups, and their social organizations were similar—with headman aiding in conflict resolution. Religious beliefs varied among the three groups. (USBR 1996.)

Tulare Lake Basin

Archaeology

Prehistoric resources in the Tulare Lake Basin are similar to those found in the regions described above. However, the Tulare Lake Basin is known to have some of the oldest archaeological deposits found in California (Dillon 2002:Table 1, Figure 5). The artifacts have been found in surface scatters and isolates, and consist of fluted projectile points that have been dated by typological association to the terminal Pleistocene and may be associated with Rancholabrean fossils (Moratto 1984:111). This cultural period spans between 10,900 B.P. and 11,200 B.P. It is characterized by fluted projectile points (called Clovis points) found on the same surface with the bones of animals now extinct, such as mammoths, sloths, and camels, indicating a primary large game hunting subsistence strategy. Recorded sites are found in higher density near waterways. Prehistoric sites in the lower elevations of the southern Sierra Nevada are quite similar to those in the foothills of the San Joaquin Valley and are related to resources based on higher elevations. The variation between the eastern and western portions of the basin is characterized by the trade relationship, with the coastal population represented by marine shell artifacts—mostly found with burials. In the Tulare Lake Basin, more than 8,500 prehistoric archaeological sites and over 200 sites that contain both historic and prehistoric components (Table 5.3-1) have been recorded. Prehistoric site types include occupation and burial sites, house pits, lithic scatters, milling stations, artifact scatters, quarries, rock art, trails, temporary camps, and charm stone caches (USBR 1996:II-39).

Ethnography

The Tulare Lake Basin includes territories occupied or partially occupied by the following California Indian groups: Tubatulabal, Kitanemuk, Costanoan, Yokuts (discussed above), and Chumash. The Tubatulabal lived in the area from Mt. Whitney to the north, Walker Pass to the east, and the San Joaquin Valley to the west. Much of this area is extremely mountainous, and the core area of settlement was the Kern and south fork Kern River valleys. The core area of the Kitanemuk people

[2] Primarily designs made in relief on the ground surface via carving or the removal of stones (Moratto 1984:591).

was the Tehachapi Mountains at the southern end of the San Joaquin Valley. The Chumash inhabited the central coastal area of California from approximately San Luis Obispo in the north to Malibu Canyon in the south and inland as far as the west side of the San Joaquin Valley. The Southern Valley Yokuts inhabited the southern San Joaquin Valley from about Fresno to the Tehachapi Mountains (Wallace 1978b:Figure 1). The Foothill Yokuts inhabited the western slopes of the Sierra Nevada foothills from about the Fresno River to the Kern River (Spier 1978:Figure 1). Although these groups also followed a seasonal round subsistence economy, they were more diversified because of the environmental differences of each geographic region. Little is known about the Kitanemuk; it is believed that they were assimilated into various missions, which effectively destroyed their culture. The Tubatulabal exploited the resources on the east and west slopes of the Sierra Nevada, living in hamlets in winter and small temporary camps in summer. On the other hand, the Chumash are considered to have been one of the most elaborate cultures in California. Archeological evidence of Chumash culture is found in the remains of large villages with large populations, social ranking, intensive trade, craft specialization, and well-developed art styles (Moratto 1984:118–119).

Historic Setting

Although records indicate that Pedro Fages and Colonel Juan Bautista de Anza entered portions of the Central Valley while on reconnaissance expeditions during the 1770s, much of the Central Valley was explored during the early 1800s. During that period, Spaniards guided expeditions through the area while hunters and fur trappers, including Jedediah Strong Smith and Ewing Young, traversed the region. John C. Fremont entered the area in 1845. During the 1840s, Mexican land grants were established throughout the Central Valley Region. The discovery of gold in the Sierra Foothills during the late 1840s brought an onslaught of incoming miners into the Central Valley Region by the 1850s. Although this population increase was patterned in clusters surrounding mines, all three basins experienced an increase. The subsequent development of agriculture and irrigation is discussed below for each of the three basins.

Sacramento Valley Basin

The Sacramento Valley Basin is comprised of 20 counties, including Modoc, Siskiyou, Shasta, Lassen, Tehama, Plumas, Butte, Glenn, Sierra, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, Sutter, Colusa, Lake, Napa, and Solano. The region is mostly characterized by flat valley lands, (part of the Great Central Valley) and is enclosed by mountain ranges on the north, east, and west sides. The Sacramento and San Joaquin Rivers run throughout the area, totaling over 430 miles long and 50 miles wide including offshoot streams.

By the 1840s, several Mexican land grants were established in the area, including the Rancho del Paso and New Helvetia. Many of these grants were used for ranching. In 1849, the discovery of gold in the region resulted in the influx of thousands of miners into the area and the sprouting of many makeshift towns. Following the decline of gold mining during the late 1800s, agriculture became a major industry in the basin. Railroad expansion into the region, including the Southern Pacific Railroad, during the mid-19th century brought on a surge of residential, commercial, and industrial development. During the mid-20th century, industry and residential development continued to expand over much of the region, while parts of the region remained relatively rural. Two military bases (Mather and McClellan), freeway development, and continual economic and population growths led to the greater development of regions such as Sacramento County; while areas such as Sutter County and Butte County developed a large agriculturally based economy, raising a variety of crops including fruits and grain (Beck and Haase 1974:67, 87; Kyle et. al. 1990:494–495; Phillips and Miller 1915:73–75; Wells and Chambers 1973; 111, 205–208).

Agriculture

The temperate climate of the Sacramento Valley Basin and its abundant fertile land made agricultural development a successful endeavor throughout much of the 19th century and well into the 20th century. Wheat, barley, and grain farming; vineyards; fruit orchards; and cattle ranching were commonly engaged in by settlers throughout the region. Fruit farming in particular gained prominence during the late 1880s. At the turn of the 20th century, irrigation improvements introduced new crops to the region, including rice, hay, and barley. Industrialization brought on commercial enterprises related to agriculture and livestock. Among the region's principal industries were rice mills, dried fruit companies, vegetable and fruit packing plants, and feed and barley plants. Following a lull in production during the Great Depression of the 1930s, by the mid-20th century and especially following World War II, livestock raising and fruit and nut production gained popularity. Although development has gained a foothold throughout much of the region, agricultural remains a large industry into the present day (Beck and Haase 1974:94–97; Caltrans 2007:25–27; Thompson and West 1880:190–196).

Irrigation/Water Conveyance

Irrigation and water conveyance efforts began in the Sacramento Valley Basin during the 1850s, when residents experienced repeated droughts and floods. Settlers constructed levees to protect against flood damage and mining ditches (eventually used as canal systems) to irrigate agricultural crops. With the advent of sluicing and hydraulic mining during the 1870s, transporting water became an extremely profitable endeavor, and numerous companies quickly formed to begin construction of waterworks in order to distribute water from rivers and creeks that meandered across the slopes and ridges of the foothill region. South Yuba Water Company, formed in 1854, owned one of the largest water conveyance systems in the Placer County area. By the late 1880s, legislation, including the Wright Irrigation Act of 1887, resulted in the founding of several irrigation districts, including the Central Irrigation District in Colusa County (later absorbed by the Glenn-Colusa Irrigation District) within the region. During the early 20th century, irrigation districts completed construction of canal systems throughout the basin, including the Glenn-Colusa Canal, that irrigated thousands of acres of agricultural land. Irrigation districts such as the Solano County Irrigation District (formed in 1948) continued to organize during the mid-20th century; work was focused on dam construction and water conveyance for farming and residential uses. Also during the mid-20th century, the State Water Project (SWP) constructed several systems and canals throughout the region to irrigate over 4.5 million acres of land statewide. The successful development of these irrigation and conveyance systems helped to support the flourishing agricultural industry throughout the basin (Caltrans and JRP Historical Consulting Services 2000:80; Kyle et. al. 1990:519; Lardner and Brock 1924; 370).

San Joaquin Valley Basin

The San Joaquin Valley Basin encompasses 14 counties, including El Dorado, Sacramento, Amador, Alpine, Calaveras, Contra Costa, San Joaquin, Stanislaus, Tuolumne, Mariposa, Merced, Madera, Fresno, and San Benito. The basin is characterized by canyons, mountain ranges, and rivers, although portions of the basin are flatlands. By the mid-19th century, property within the region was claimed through several Mexican land grants known as *ranchos.* Two of these properties were located in Contra Costa County: Rancho San Pablo and Rancho San Ramon. During the mid-1800s, the discovery of gold in the region brought an onslaught of miners and settlers into the area. Following the decline of mining in the latter 19th century, agriculture became a major industry in the region. Railroad expansion into the region was accompanied by a surge of residential, commercial, and industrial development during this period; this trend continued through the 20th century, as highways and freeways entered the area (Kyle et. al. 1990:28–36, 53–68, 198, 209–215, 494–495).

Agriculture

Euroamericans first cultivated agriculture in the San Joaquin Valley Basin during the mid-1800s, when miners and other settlers began tilling arid soil for relief from high-priced produce. Early settlers planted an increasing number of orchards and vineyards throughout the foothills region, causing the area to become an important fruit growing and processing hub. Placerville served as the center of the El Dorado County fruit packing industry. By the turn of the 20th century, lumbering, livestock raising (including cattle and sheep), and farming had joined mining as the principal industries of the county. Crops included pears, plums, apples, peaches, cherries, oranges, olives, walnuts, wheat, rye, corn, and acres of vineyards. Today, the San Joaquin Valley Basin accounts for 43 percent of the state's agriculture (Thompson 1958:309, 318, 374, 387).

Irrigation/Water Conveyance

Irrigation efforts within the San Joaquin Valley Basin began during the late 1800s, when private land owners attempted to obtain water to irrigate their land for agricultural purposes. During the late 19th century, locally organized irrigation districts began constructing canals within the region, including the largest single irrigation system in California during that time, the San Joaquin and Kings River Canal. Private water companies such as the James Ben Ali Haggin's Kern County Land Company and the Miller and Lux Company worked to organize irrigation projects, dividing water between corporations and individuals in the region. These private companies reduced in size following involvement of the federal government during the 1930s with the Central Valley Project (CVP). The CVP created five umbrella units in the region to convey water throughout the state, including the Friant-Kern Canal and Contra Costa Canal. As noted above, by the mid-20th century, the SWP achieved irrigating the over 4.5 million acre region with its multitude of systems and canals (Beck and Haase 1974:76, 94–97; Caltrans and JRP Historical Consulting Services 2000:73–75).

Tulare Lake Basin

The Tulare Lake Basin encompasses a large portion of Fresno, Kings, Tulare, and Kern Counties. In addition, this basin includes small southeastern segments of San Benito, and San Luis Obispo Counties, and dips into the northern tips of Ventura and Los Angeles Counties. The small portions of Los Angeles and San Luis Obispo Counties that are within the program area contain no identified irrigated lands as defined by the program. Ventura County has only a small portion of land within the program area, with a very tiny area identified as "pasture" in the DWR land-use figure (Figure 3-58 of the ECR). Consequently, a *de minimis* approach with respect to potential impacts in these counties has been taken, and the numbers of known cultural resources located in these counties is not included in this analysis.

Following early settlement, expansion of the Southern Pacific Railroad (SPRR) during the early 1900s provided access to the region, resulting in the founding of many small towns in the southern portion of the Central Valley. These towns furnished goods and employment, and continued to flourish through the 20th century (Kyle et. al. 1990:88–97, 124–137, 139–140; Small 1926:415).

Agriculture

The Tulare Lake Basin is characterized by flat, dry lands, which made early agricultural efforts difficult. Cattle, hog, and sheep ranching in the valley were dominant during the mid-1800s. The expansion of the SPRR into the area during the 1880s and a developing irrigation system resulted in a rise of agricultural production. New crops included apples, peaches, plums, apricots, nectarines, grapes, figs, oranges, and berries as well as grapes, vegetables, barley, hay, and cotton. Communities dedicated to agriculture began settling in the region during the late 1800s, developing a local raisin industry which remains today. Because of irrigation in the basin and intensive farming practices, small farming rapidly became a prominent feature of the area. In addition to the crops noted above, farmers began to plant alfalfa and corn to feed the cattle of the growing local dairy industry. Although land uses changed somewhat during the last half of the 20th century, the overall crop pattern of cotton, alfalfa, and corn remained relatively consistent in the region. Additional specialty crops such as walnuts and turf pasture mixed with the established crops between the 1950s and the 1990s. The number of dairies and farmsteads remained steady in parts of the region but were often integrated with larger and more distant corporations (Beck and Haase 1974:76, 94–97; DWR 1958, 1978, 1985, 1993; Elliot 1883:99; Tulare County Board of Trade 1915:9).

Irrigation/Water Conveyance

Irrigation efforts in the Tulare Lake Basin began during the late 1850s and 1860s, when local ranchers constructed their own water conveyance systems that included ditches with rough earthen linings for conveying water over relatively short distances. The Miller and Lux Company encouraged development of the San Joaquin and Kings River Canal, which in turn promoted settlement throughout the region. During the 1930s, the CVP played a large role in irrigation and water conveyance within the region. The CVP created the Friant-Kern Dam and Madera Canal among other systems, which irrigate the eastern side of the San Joaquin Valley in the north part of the Tulare Lake Basin. As noted above, the mid-20th century, the SWP included several systems and canals throughout the region, working to irrigate over 4.5 million acres of land statewide (Caltrans and JRP Historical Consulting Services 2000:80; Kyle et al. 2002:94–95; Mitchell 1974:59; Robinson 1948:1982, 192).

5.3.4 Impacts

This section describes the possible effects on cultural resources of likely management practices. As the specific nature and location of those practices is unknown, the impacts of each program alternative are discussed at a programmatic level.

Assessment Methods

The assessment of potential impacts on cultural resources was qualitative by necessity, given the lack of substantial information regarding the extent of environmental changes that may arise from adoption of program alternatives. The analyzed program area consists of all or part of 36 counties, and the locations of potential ground-disturbing activities that could result from the proposed program alternatives are not known with any specificity. Consequently, it was not appropriate or beneficial to conduct a standard records search through the California Historical Resources Information System (CHRIS) information centers, or to consult with Native American groups or regional historical societies. Furthermore, no project-level archaeological or built environment pedestrian surveys have been conducted for this analysis.

For the purpose of this analysis, the effort to identify cultural resources within the program area consisted of contacting the California State Office of Historic Preservation (OHP) to identify the numbers of cultural resources located in each county in the program area. OHP data do not indicate the exact location of each resource, so it is unknown how many resources lie within irrigated lands. The information obtained from OHP is shown in Table 5.3-1.

These data represent properties listed in, or formally determined eligible for listing in, the National Register of Historic Places (NRHP) and the CRHR, as well as properties listed as California State Landmarks and California Points of Historical Interest. Consequently, Table 5.3-1 only includes those cultural resources that have been identified, reported, and evaluated for significance according to one or more of the cultural resource management programs listed in the previous sentence. The properties include individual buildings, structures, objects, sites, and historic districts. The numbers of cultural resources are presented by county and are grossly classified as built environment or archaeological resources. For this analysis, the historic districts were counted as one resource.

These numbers do not represent an accurate accounting of resources potentially impacted by the program; rather, they are intended only to provide context to a qualitative discussion of the quantity of resources present. Numerous cultural resources identified in the program area have not been evaluated for their significance, and much of the program area has not been subjected to cultural resource surveys. However, it is reasonable to assume that many of these resources do not lie within irrigated lands where water quality impairments are present, primarily the valley floor. The figures presented in Table 5.3-1 therefore should be regarded, on balance, as minimum totals for cultural resources present throughout the affected counties; the number of cultural resources in the program area in those counties most likely is substantially less than shown in Table 5.3-1.

Table 5.3-1. Numbers of Cultural Resources Identified in Counties in the Program Area

		Archaeological Sites		
County	**Built Environment**	**Prehistoric**	**Historic**	**Both**
Alameda	11,944	161	66	17
Alpine	27	290	92	20
Amador	404	263	39	16
Butte	421	774	152	60
Calaveras	249	998	619	80
Colusa	273	131	43	17
Contra Costa	727	283	100	21
El Dorado	185	396	122	28
Fresno	410	2,278	314	64
Glenn	19	49	10	4
Kern	253	2,852	1,202	142
Kings	46	67	7	4

		Archaeological Sites		
County	**Built Environment**	**Prehistoric**	**Historic**	**Both**
Lake	35	1277	126	71
Lassen	26	1,100	94	47
Madera	91	1,683	229	65
Mariposa	423	972	463	109
Merced	808	296	77	53
Modoc	288	1,525	90	54
Napa	738	663	67	23
Nevada	372	259	204	32
Placer	495	363	108	17
Plumas	67	434	197	33
Sacramento	1,013	358	28	10
San Benito	452	153	47	8
San Joaquin	2,363	169	90	29
Shasta	116	1,191	536	210
Sierra	41	272	340	70
Siskiyou	122	648	285	62
Solano	2,242	136	45	11
Stanislaus	539	307	78	22
Sutter	21	56	6	0
Tehama	92	1,030	197	97
Tulare	760	1,580	201	38
Tuolumne	474	2,316	1,302	248
Yolo	743	122	6	0
Yuba	306	743	434	33
Totals for Counties in Program Area	27,585	26,195	8,016	1,815

Notes:

Only small portions of Los Angeles and San Luis Obispo Counties are within the program area, and contain no irrigated lands as defined by the program. Ventura County has only a small portion of land within the program area, with a very tiny area identified as "pasture" in the DWR land-use figure (Figure 3-58 in the *Existing Conditions Report* [ICF Jones & Stokes 2008]). Consequently, a *de minimis* approach with respect to potential impacts in these counties has been taken, and the numbers of known cultural resources located in these areas are not included in this analysis.

For this analysis, the historic districts were counted as one resource.

Table 5.3-1 indicates that 26,195 prehistoric archaeological sites, 8,016 historic archaeological sites, and 1,815 archaeological sites that contain both prehistoric and historic components have been identified in the counties in the program area. Using these data to inform the impact analysis is not straightforward for two reasons. As noted, the figures presented in Table 5.3-1 generally should be regarded as minimum figures because the table accounts only for resources that have been evaluated under state and federal preservation programs. In addition, the totals and subtotals in Table 5.3-1 do not capture the distribution of archaeological resources within the counties. Some counties may have received extensive archaeological surveys, whereas others may have seen minimal surveys. Nevertheless, when Table 5.3-1 is read in conjunction with the "Environmental Setting" herein, some consequential trends are noticeable. Counties with high acreage under cultivation or rangeland, such as Fresno, Kern, Madera, and Tulare, possess among the highest numbers of evaluated archaeological resources. Counties with high rice cultivation, like Colusa and Sutter, have low numbers of evaluated archaeological resources. These patterns are due in part to the character of agricultural production in these counties. Field disking temporarily removes vegetation from the farmed area, increasing the visibility of archaeological resources on the landscape, although the practice also results in damage to these resources. Resources are easily identified in recently disked fields because of the high-quality visibility conditions (Feder 1997:55). Rice cultivation, on the other hand, involves the wholesale removal of soil to form basins, which could easily result in the destruction of entire archaeological resources. These basins are subsequently flooded (and not surveyeable) for all but 1–3 months out of the year, hampering the ability of archaeologists to identify archaeological resources (Basin Research Associates 2003:11, 15; ICF Jones & Stokes 2008:34). Table 5.3-1 indicates that archaeological resources are found with some frequency throughout the program area.

As indicated in Table 5.3-1, 27,585 eligible built environment historical resources are located in the program area. It should be noted that the numbers of built environment historical resources listed in Table 5.3-1 includes all OHP-listed historical resources for each county, including urban centers where most of these resources are likely located. These resources are all either eligible for the NRHP or the CRHR and therefore historical resources for the purposes of CEQA. These historical resources include properties such as buildings, bridges, and infrastructure. It is likely that the types of built environment historical resources found in the more specific program area will be related to agricultural development, including farmsteads with multiple buildings such as residential buildings, barns, utilitarian structures, and landscape vegetation in the form of wind breaks and tree allees (trees lining both sides of a path). Water conveyance structures such as ditches, canals, and wells are built historical resources also likely to be found in the program area. The exact numbers for the agricultural-related historical resources most likely to be found in the program area remains unknown at this time. Consequently, the overall numbers of eligible built environment historical resources was used in this analysis.

Significance Determinations

According to the State CEQA Guidelines, a project has a significant effect on the environment when it may cause a substantial adverse change in the significance of an historic resource (14 CCR Section 15064.5[b]). CEQA further states that a *substantial adverse change in the significance of a resource* means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historic resource would be materially impaired. Actions that would materially impair the significance of a historic resource are those that would demolish or adversely alter those physical characteristics of an historical resource that convey its historical significance and qualify it for inclusion in the CRHR or in a local register or survey that meet the requirements of PRC Sections 5020.1(k) and 5024.1(g).

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Alternative 1 represents full implementation of the existing regulatory program. Use of coalition groups as the lead monitoring entities would continue, and third-party entities and growers would continue to implement management practices in response to identified water quality impairments. Under this alternative, management practices would be implemented to reduce the levels of identified constituents of concern below the baseline conditions. The changes in management practices would vary, depending on choices made by individual growers for their crops, locations, and local and regional water quality concerns. However, Alternative 1 does not involve any groundwater monitoring practices. Management practices possibly implemented under Alternative 1 include nutrient management; improved water management; tailwater recovery systems; pressure irrigation; sediment traps and or buffer zones, and cover cropping.

Use of nutrient and water management would have virtually no impact on cultural resources, as resulting ground disturbance would be minimal. However, tailwater recovery systems, pressure irrigation, and sediment traps could result in construction impacts, potentially from use of heavy equipment, and could affect cultural resources.

Impact CUL-1. Physical Destruction, Alteration, or Damage of Cultural Resources from Implementation of Management Practices

Growers may implement a variety of management practices that include physical and operational changes to agricultural land in the program area. Such management practices may occur near cultural resources that are historically significant and eligible for listing in the CRHR or the NRHP. Implementation of these practices may lead to physical demolition, destruction, relocation, or alteration of cultural resources.

The location, timing, and specific suite of management practices to be chosen by growers to improve water quality are not known at this time. This impact is considered significant. Implementation of **Mitigation Measure CUL-MM-1** would reduce this impact to a less-than-significant level.

Alternative 2 – Third Party Lead Entity

Monitoring, tracking, and management plan requirements of Alternative 2 are expected to result in changes in the use of management practices by growers very similar to Alternative 1, with the additional of groundwater management practices such as wellhead protection.

Impact CUL-1. Physical Destruction, Alteration, or Damage of Cultural Resources from Implementation of Management Practices

Growers may implement a variety of management practices that include physical and operational changes to agricultural land in the program area. The location, timing, and specific suite of management practices to be chosen by growers to improve water quality are not known at this time. This impact is considered significant. Implementation of **Mitigation Measure CUL-MM-1** would reduce this impact to a less-than-significant level.

Alternative 3 – Individual Farm Water Quality Management Plans

Potential impacts related to cultural resources under Alternative 3 are expected to be as described for Alternative 2.

Alternative 4 – Direct Oversight with Regional Monitoring

Potential impacts related to cultural resources under Alternative 4 are expected to be as described for Alternative 2.

Alternative 5 – Direct Oversight with Farm Monitoring

The potential changes in management practices under Alternative 5 would be similar to those described for Alternative 2. Under Alternative 5, however, individual monitoring wells would be installed and monitored, which could result in direct impacts on cultural resources.

Impact CUL-2. Potential Damage to Cultural Resources from Construction Activities and Installation of Groundwater Monitoring Wells

Construction impacts would result from implementation of management practices that require physical changes and from installation of groundwater monitoring wells. The location of monitoring wells, as well as the location, timing, and specific suite of management practices to be selected by growers are not known at this time, and will not be defined until GQMPs are prepared by growers and other responsible parties. This impact is considered significant. Implementation of **Mitigation Measure CUL-MM-1** would reduce this impact to a less-than-significant level.

Mitigation and Improvement Measures

Mitigation Measure CUL-MM-1: Avoid Impacts to Cultural Resources

The measure described below will reduce the severity of impacts on significant cultural resources, as defined and described in Sections 5.3.1 and 5.3.3 of this chapter. Avoidance of such impacts also can be achieved when growers choose the least impactful management practices that will effectively meet the ILRP water quality improvement goals and objectives. Note that these measures may not be necessary in cases where no ground-disturbing activities would be undertaken as a result of implementation of the ILRP.

Although cultural resource inventories and evaluations typically are conducted prior to preparation of a CEQA document, the size of the program area, the programmatic nature of the alternatives, and the lack of specificity regarding the location and type of management practice that would be implemented following adoption of an alternative render conducting inventories prior to release of this draft PEIR untenable. Therefore, where the ILRP water quality improvement goals cannot be achieved without modifying or disturbing an area of land or existing structure to a greater degree than through previously employed farming practices, individual farmers, coalitions, or third-party representatives should implement the following measures to reduce potential impacts to less-than-significant levels.

- Where construction within areas that may contain cultural resources cannot be avoided through the use of alternative management practices, conduct an assessment of the potential for damage to cultural resources prior to construction; this may include the hiring of a qualified cultural resources specialist to determine the presence of significant cultural resources;

- Where the assessment indicates that damage may occur, submit a non-confidential records search request to the appropriate CHRIS information center(s) (see Table 5.3-2 below);
- Implement the recommendations provided by the CHRIS information center(s) in response to the records search request; and
- Where adverse effects to cultural resources cannot be avoided, undertake additional CEQA review and develop appropriate mitigation to avoid or minimize the potential impact.

Table 5.3-2. CHRIS Information Centers by Program County

County	CHRIS Information Center
Alpine	Central California
Amador	North Central
Butte	Northeast
Calaveras	Central California
Colusa	Northwest
Contra Costa	Northwest
El Dorado	North Central
Fresno	Southern San Joaquin Valley
Glenn	Northeast
Kern	Southern San Joaquin Valley
Kings	Southern San Joaquin Valley
Lake	Northwest
Lassen	Northeast
Madera	Southern San Joaquin Valley
Mariposa	Central California
Merced	Central California
Modoc	Northeast
Napa	Northwest
Nevada	North Central
Placer	North Central
Plumas	Northeast
Sacramento	North Central
San Benito	Northwest
San Joaquin	Central California
Shasta	Northeast
Sierra	Northeast
Siskiyou	Northeast
Solano	Northwest
Stanislaus	Central California
Sutter	Northeast

County	CHRIS Information Center
Tehama	Southern San Joaquin Valley
Tulare	Southern San Joaquin Valley
Tuolumne	Central California
Yolo	Northwest
Yuba	North Central

Information Center contact information is available at: <http://www.ohp.parks.ca.gov/pages/1068/files/IC%20Roster.pdf>.

In addition, California state law provides for the protection of interred human remains from vandalism and destruction. According to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and the disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of the discovered human remains until the County Coroner has been notified, according to PRC Section 5097.98, and can determine whether the remains are those of Native American origin. If the coroner determines that the remains are of Native American origin, the coroner must contact the Native American Heritage Commission (NAHC) within 24 hours (Health and Safety Code Section 7050[c]). The NAHC will identify and notify the most likely descendant (MLD) of the interred individual(s), who will then make a recommendation for means of treating or removing, with appropriate dignity, the human remains and any associated grave goods as provided in PRC Section 5097.98.

PRC Section 5097.9 identifies the responsibilities of the project proponent upon notification of a discovery of Native American burial remains. The project proponent would work with the MLD (determined by the NAHC) and a professional archaeologist with specialized human osteological experience to develop and implement an appropriate treatment plan for avoidance and preservation of, or recovery and removal of, the remains.

Growers implementing management practices should be aware of the following protocols for identifying cultural resources:

- If built environment resources or archaeological resources, including chipped stone (often obsidian, basalt, or chert), ground stone (often in the form of a bowl mortar or pestle), stone tools such as projectile points or scrapers, unusual amounts of shell or bone, historic debris (such as concentrations of cans or bottles), building foundations, or structures are inadvertently discovered during ground-disturbing activities, the land owner should stop work in the vicinity of the find and retain a qualified cultural resources specialist to assess the significance of the resources. If necessary, the cultural resource specialist also will develop appropriate treatment measures for the find.
- If human bone is found as a result of ground disturbance, the land owner should notify the County Coroner in accordance with the instructions described above. If Native American remains are identified and descendents are found, the descendants may—with the permission of the owner of the land or his or her authorized representative—inspect the site of the discovery of the Native American remains. The descendants may recommend to the owner or the person responsible for the excavation work means for treating or disposing of the human remains and any associated grave goods, with appropriate dignity. The descendants will make their recommendation within 48 hours of inspection of the

remains. If the NAHC is unable to identify a descendant, if the descendants identified fail to make a recommendation, or if the landowner rejects the recommendation of the descendents, the landowner will inter the human remains and associated grave goods with appropriate dignity on the property in a location not subject to further and future subsurface disturbance.

5.4.1 Introduction

This section describes potential noise impacts associated with the five program alternatives. Specifically, it summarizes relevant laws and policies, discusses the existing conditions in the program area with respect to noise, and identifies significant impacts that may result from implementation of program alternatives. Mitigation measures to avoid or reduce impacts also are presented.

In order to provide the necessary background to understand noise-related regulations and impacts, a brief discussion on noise terminology is warranted. *Sound* is mechanical energy (vibration) transmitted by pressure waves through a medium such as air or water. *Noise* is commonly defined as unwanted sound that annoys or disturbs people and can potentially cause adverse psychological or physiological effects on human health. Because noise is an environmental pollutant that can interfere with human activities, evaluation of noise is necessary when considering the environmental impacts of a proposed project.

Sound is characterized by various parameters that include the rate of oscillation of sound waves (*frequency*), the speed of propagation, and the pressure level or energy content (*amplitude*). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient (existing) sound level. The decibel (dB) scale, a logarithmic scale, is used to quantify sound intensity. Because the human ear is not equally sensitive to all frequencies in the entire spectrum, noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called "A-weighting," written as "dBA" and referred to as "A-weighted decibels." Table 5.4-1 provides definitions of sound measurements and other terminology used in this section, and Table 5.4-2 summarizes typical A-weighted sound levels for common noise sources.

Table 5.4-1. Definitions of Sound Measurements

Sound Measurements	Definition
Decibel (dB)	A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
A-weighted decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
Maximum sound level (L_{max})	The maximum sound level measured during the measurement period.
Minimum sound level (L_{min})	The minimum sound level measured during the measurement period.
Equivalent sound level (L_{eq})	The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy.
Percentile-exceeded sound level (L_{xx})	The sound level exceeded "x" percent of a specific time period. L10 is the sound level exceeded 10 percent of the time. L90 is the sound level exceeded 90 percent of the time. L90 is often considered to be representative of the background noise level in a given area.

Sound Measurements	Definition
Day-night level (L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
Community noise equivalent level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
Peak particle velocity (peak velocity or PPV)	A measurement of ground vibration defined as the maximum speed (measured in inches per second) at which a particle in the ground is moving relative to its inactive state. PPV is usually expressed in inches/second.
Frequency: Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.

Table 5.4-2. Typical A-Weighted Sound Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	—110—	Rock band
Jet flyover at 1,000 feet		
	—100—	
Gas lawnmower at 3 feet		
	—90—	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	—80—	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower at 100 feet	—70—	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	—60—	
		Large business office
Quiet urban daytime	—50—	Dishwasher in next room
Quiet urban nighttime	—40—	Theater, large conference room (background)
Quiet suburban nighttime		
	—30—	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	—20—	
		Broadcast/recording studio
	—10—	
	—0—	

Source: Caltrans 1998.

In general, human sound perception is such that a change in sound level of 1 dB cannot typically be perceived by the human ear, a change of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level.

As described in Table 5.4-1, different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (L_{eq}), the minimum and maximum sound levels (L_{min} and L_{max}), percentile-exceeded sound levels (such as L_{10}, L_{20}), and the day-night sound level (L_{dn}).

For a point source such as a stationary compressor or construction equipment, sound attenuates based on geometry at a rate of 6 dB per doubling of distance. For a line source such as free-flowing traffic on a freeway, sound attenuates at a rate of 3 dB per doubling of distance (Caltrans 1998). Atmospheric conditions including wind, temperature gradients, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically in the range of 1 to 2 dB per doubling of distance. Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance. Typically, a barrier that blocks the line of sight between a noise source and a receiver will reduce sound by at least 5 dB.

5.4.2 Regulatory Framework

This section discusses regulations related to noise that may apply to the program alternatives.

Federal

No federal noise regulations are applicable to the program alternatives.

State

No state noise regulations are applicable to the program alternatives.

Local

Noise from construction and other activities is generally regulated at the local level by cities and counties through the enforcement of adopted noise ordinances. The ordinances serve as enforcement mechanisms for controlling noise. General plan noise elements are used as planning guidelines to ensure that planned land uses are compatible with long-term noise in the area. Typically, noise ordinance standards rather than general plan noise element standards apply to noise from construction activities. In many cases, noise from construction activity is exempt from specific limits during daytime hours. Typical construction noise limits in local regulations range from 50 to 60 dBA during daytime hours and from 45 to 55 dBA during nighttime hours.

The program area encompasses all or part of 36[1] counties and multiple cities and towns. Many of these jurisdictions have their own noise ordinances and general plan noise elements.[2] Since the majority of program activities will occur on agricultural lands, which are typically located in rural areas far from densely populated cities, only those ordinances at the county level are anticipated to apply to the program alternatives.

5.4.3 Environmental Setting

Existing Noise Levels in the Program Area

Ambient noise levels are to a great extent dependent on the amount of development in an area. In agricultural areas, ambient noise levels are governed primarily by farming activities and traffic on local roadways. Other less dominant sources of noise include aircraft that occasionally fly overhead and animals, such as birds and insects. Table 5.4-3 shows typical ambient noise levels based on land use type. Noise levels within the program area are expected to range between 45 and 55 dBA.

Table 5.4-3. Land Uses and Associated Ambient Noise Levels

Scenario	dBA, L_{dn}
Rural	40–50
Suburban	
Quiet suburban residential or small town	45–50
Normal suburban residential	50–55
Urban	
Normal urban residential	60
Noisy urban residential	65
Very noise urban residential	70
Downtown, major metropolis	75–80
Under flight path at major airport, 0.5 to 1 mile from runway	78–85
Adjoining freeway or near a major airport	80–90
Sources: Cowan 1984; Hoover and Keith 1996.	

Noise-Sensitive Land Uses in the Program Area

Noise-sensitive land uses are generally considered to be places where people reside, such as residences and health care facilities. Other land uses, such as parks, where quiet can be an important part of how the area is used also can be considered sensitive to noise. Numerous small towns and major cities with residences, health care facilities, and parks are located throughout the program

[1] Small portions of Los Angeles and San Luis Obispo Counties are within the project boundary but have no irrigated lands as defined by the program. A small portion of land in Ventura County that is within the program boundary is identified as "pasture." However, potential impacts caused by the proposed program in Ventura County are beyond the scope of this document and are not included in the analysis.

[2] Although not all are cited in this document, references to noise ordinances and general plans from each of the counties within the program area are included in Chapter 8, References.

area. However, as farms typically are located in rural areas, the number of sensitive receptors affected by the program alternatives is expected to be minimal.

5.4.4 Impacts

Noise impacts from the program alternatives would result from construction activities and program operation. This section describes the potential impacts related to these sources resulting from the five program alternatives. It is unlikely that the minimal amount of construction or heavy-duty equipment would cause any impacts related to vibration. Mitigation measures to reduce potentially significant impacts also are identified.

For the purposes of this analysis, the baseline conditions were assumed to be the current regulatory program as instituted at the time of the writing of the ECR (refer to Chapter 3).

Assessment Methods

Construction Activities

Management practices used to prevent impacts on water quality that require heavy-duty equipment would generate temporary or periodic increases in ambient noise levels. In addition, installation of monitoring wells and construction of all accessory facilities (e.g., pump houses and access roads) would result in elevated ambient noise levels. Management practices most likely requiring the use of heavy-duty equipment include sediment trap, hedgerow, or buffer; pressurized irrigation; wellhead protection; and tailwater recovery systems (see Table 5.5-8).

Table 5.4-4 identifies equipment that may be required to construct catchment ponds, berms, physical barriers, and wells associated with these management practices. The table also provides typical noise levels produced by each piece of equipment based on information developed by the Federal Highway Administration (2006).

Table 5.4-4. Typical Construction Equipment Associated with Management Practices and Associated Noise Levels

Equipment	Typical Noise Level 50 feet from Source (dBA)
Track excavator	81
Track backhoe/loader	79
Crane, mobile	81
Water truck	74
Pickup truck	75
Drill rig[a]	79

Notes:
[a] A drill rig may be required for installation of groundwater monitoring wells and tailwater system wells. Information obtained from Hoover & Keith 2008.
Sources: FHWA 2006; Hoover & Keith 2008.

Noise from construction activity typically attenuates at a rate of 6 dB per doubling of distance (FHWA 2006). A reasonable worst-case condition assumes that a drill rig, crane, and excavator are operating in the same location, for a combined noise level of 85 dBA at 50 feet. Table 5.4-5 illustrates predicted noise levels at various distances assuming a source noise level of 85 dBA at 50 feet as a reasonable worst-case scenario.

Table 5.4-5. Estimated Noise Levels at Various Distances

Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	85
100	79
200	73
400	68
500	65
600	63
800	62
1,000	59
1,500	55
2,000	53
2,500	51
3,000	49

The number and types of heavy-duty equipment would vary, depending on the management practices implemented under a program alternative. Since the selection of management practices is a function of crop type, physical setting, and economics, rather than regulatory authority, it is difficult to determine which management practices would be selected as a result of the proposed alternatives (ICF Jones & Stokes 2008). However, in general, construction required by the various management practices is expected to be minor.

With limited information on the type of management practices resulting from implementation of the program alternatives, a quantified analysis of potential noise impacts is not possible. Consequently, a qualitative assessment was performed. The qualitative analysis took into account the following:

- Interrelationship between monitoring and implementation of management practices,
- Stipulations for installation of monitoring wells,
- Anticipated equipment (Table 5.4-4), and
- Estimated noise levels at various distances (Table 5.4-5).

Program Operation

Implementation of the program alternatives would result in transportation-related noise from vehicle trips for site inspections and monitoring. Individual groundwater or tailwater recovery system wells that require pump motors also would generate minor increases in noise above ambient levels. These sources are expected to be transitory and short term (e.g., semi-annual well sampling and annual inspections), but the extent of these activities is unknown at this time.

Certain management practices also may reduce noise levels relative to existing conditions. For example, improved irrigation management may reduce the amount of time that pressurized pump generators are used. Enhanced nutrient application also may minimize the number of tractors required to fertilize or plow a field. However, as discussed above, the extent and intensity of these activities are unknown. Consequently, a quantitative analysis of operations-related noise impacts is not possible, and a qualitative assessment was performed. The qualitative assessment took into account provisions for groundwater monitoring plans and wells, as well as the frequency and responsible party for site inspections.

Significance Determinations

For this analysis, an impact pertaining to noise was considered significant under CEQA if it would result in any of the following environmental effects, which are based on professional practice and State CEQA Guidelines Appendix G (14 CCR 15000 et seq.):

- Expose persons to or generate noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies,
- Expose persons to or generate excessive ground-borne vibration or ground-borne noise levels,
- Result in a substantial permanent increase in ambient noise levels in the program vicinity above levels existing without the program, or
- Result in a substantial temporary or periodic increase in ambient noise levels in the program vicinity above levels existing without the program.

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Impact NOI-1. Exposure of Sensitive Land Uses to Noise from Construction Activities in Excess of Applicable Standards

Alternative 1 involves full implementation of the existing regulatory program. Coalition groups would function as the lead entities, and growers would implement management practices when surface water monitoring data show two or more exceedances of water quality objectives.

Construction noise impacts would result from implementation of management practices that require the use of heavy-duty equipment. Because management practices are a function of crop type and economics, it cannot be determined whether the management practices selected under this alternative would change relative to existing conditions. It is therefore not possible to determine construction-related effects based on a quantitative analysis. However, it is logical to assume that, as monitoring continues under Alternative 1, it would result in selection and implementation of more management plans and resulting management practices.

As shown in Table 5.4-5, noise levels from potential construction equipment are expected to range from approximately 55 to 88 dBA at 50 feet. These levels would be short term and would attenuate as a function of distance from the source. Noise from construction equipment operated within several hundred feet of noise-sensitive land uses has the potential to exceed local noise standards. This is considered a potentially significant. Implementation of **Mitigation Measure NOI-MM-1** by growers would reduce this impact to a less-than-significant level.

Impact NOI-2. Exposure of Sensitive Land Uses to Noise from Operational Activities in Excess of Applicable Standards

Under Alternative 1, coalition groups would perform surface water monitoring. Surface water quality monitoring is already occurring under existing conditions. Alternative 1 is therefore not expected to result in an appreciable difference in operational noise levels related to vehicle trips for monitoring.

Construction of new well pumps as part of tailwater recovery systems may result in increased noise levels relative to existing conditions. Noise generated from individual well pumps would be temporary and sporadic. Information on the types and number of pumps, as well as the number and distances of vehicle trips, is currently unavailable.

Depending on the type of management practice selected, Alternative 1 also may result in noise benefits relative to existing conditions. For example, as discussed above, improved irrigation management may reduce the amount of time that pressurized pump generators are used. Enhanced nutrient application may minimize the number of tractors required to fertilizer or plow a field. Removing these sources of noise may mediate any increases related to the operation of new pumps. However, in the absence of data, a quantitative analysis of noise impacts related to operations of Alternative 1 is not possible. Potential noise from unenclosed pumps located close to noise-sensitive uses could exceed local noise standards. This is considered a potentially significant impact. Implementation of **Mitigation Measures NOI-MM-1** and **NOI-MM-2** would reduce this impact to a less-than-significant level.

Alternative 2 – Third-Party Lead Entity

Impact NOI-1. Exposure of Sensitive Land Uses to Noise from Construction Activities in Excess of Applicable Standards

As discussed previously, it is difficult to determine how changes in the lead entity as a result of the program alternatives would affect, if at all, the management practices used to prevent water quality impacts. Consequently, impacts related to construction noise under Alternative 2 are expected to be similar to those described for Alternative 1 (see **Impact NOI-1**). However, because wellhead protection, which requires the use of heavy-duty equipment, may be implemented by some farmers as a management practice (see Table 5.5-8), construction noise levels may be slighter greater than those anticipated for Alternative 1. Noise from construction equipment operated within several hundred feet of noise-sensitive land uses has the potential to exceed local noise standards. This is considered a potentially significant impact. Implementation of **Mitigation Measure NOI-MM-1** would reduce this impact to a less-than-significant level.

Impact NOI-2. Exposure of Sensitive Land Uses to Noise from Operational Activities in Excess of Applicable Standards

Under Alternative 2, third-party groups would perform surface water and groundwater monitoring. This alternative allows for a reduction in surface water quality monitoring under lower threat circumstances or when watershed or area management objective plans have been adopted. In these instances, the number of trips and related noise at sensitive receptors that are associated with surface water quality monitoring may be reduced relative to existing regulations. Although requirements for new groundwater monitoring may result in additional vehicle trips, the vehicle trips associated with groundwater monitoring would occur less than once a month.

Noise levels associated with operation of new well pumps and implementation of conservation strategies (e.g., improved irrigation and enhanced crop management) would be similar to those described for Alternative 1. Potential noise from unenclosed pumps located close to noise-sensitive uses could exceed local noise standards. This impact is considered potentially significant. Implementation of **Mitigation Measures NOI-MM-1** and **NOI-MM-2** would reduce this impact to a less-than-significant level.

Alternative 3 – Individual Farm Water Quality Management Plans

Impact NOI-1. Exposure of Sensitive Land Uses to Noise from Construction Activities in Excess of Applicable Standards

Impacts related to construction noise under Alternative 3 are expected to be similar to those described for Alternative 2 (see **Impact NOI-1**). Construction noise impacts would result from implementation of management practices that require the use of heavy-duty equipment, and noise from construction equipment operated within several hundred feet of noise-sensitive land uses has the potential to exceed local noise standards. This is considered a potentially significant impact. Implementation of **Mitigation Measure NOI-MM-1** would reduce this impact to a less-than-significant level.

Impact NOI-2. Exposure of Sensitive Land Uses to Noise from Operational Activities in Excess of Applicable Standards

Under Alternative 3, operational noise impacts would result from vehicle trips made by the Central Valley Water Board to conduct annual site inspections on a selected number of farms, as well as any new well pumps installed as part of tailwater recovery systems. This alternative does not require growers or the Central Valley Water Board to perform surface water or groundwater monitoring. Rather, individual growers would conduct visual inspections of their own farms. Consequently, there would be no exposure of sensitive land uses to increased noise levels from this activity (e.g., vehicle travel).

Vehicle trips for grower site inspections are expected to be minimal and would occur occasionally throughout the year. Noise levels associated with operation of new well pumps and the implementation of conservation strategies (e.g. improved irrigation and enhanced crop management) would be similar to those described for Alternative 1. Potential noise from unenclosed pumps located close to noise-sensitive uses could exceed local noise standards. This impact is considered potentially significant. Implementation of **Mitigation Measures NOI-MM-1** and **NOI-MM-2** would reduce this impact to a less-than-significant level.

Alternative 4 – Direct Oversight with Regional Monitoring

Impact NOI-1. Exposure of Sensitive Land Uses to Noise from Construction Activities in Excess of Applicable Standards

Impacts related to construction noise under Alternative 4 are expected to be similar to those described for Alternative 2 (see **Impact NOI-1**). Construction noise impacts would result from implementation of management practices that require the use of heavy-duty equipment, and noise from construction equipment operated within several hundred feet of noise-sensitive land uses has the potential to exceed local noise standards. This is considered a potentially significant impact. Implementation of **Mitigation Measure NOI-MM-1** would reduce this impact to a less-than-significant level.

Impact NOI-2. Exposure of Sensitive Land Uses to Noise from Operational Activities in Excess of Applicable Standards

Operational noise impacts would result from vehicle trips made by lead entities to perform water quality monitoring, vehicle trips made by the Central Valley Water Board to perform grower site inspections, and new well pumps installed as part of tailwater recovery systems. Alternative 4 allows for individual growers to perform their own monitoring, depending on the level of threat posed by their fields to water quality. It was assumed that growers would transport water samples to the laboratory for analysis. This activity represents a minuscule source of potential traffic noise.

Vehicle trips for water quality monitoring and grower site inspections are expected to be minimal. Noise levels associated with operation of new well pumps and implementation of conservation strategies (e.g., improved irrigation and enhanced crop management) would be similar to those described for Alternative 1. Potential noise from unenclosed pumps located close to noise-sensitive uses could exceed local noise standards. This impact is considered potentially significant. Implementation of **Mitigation Measures NOI-MM-1** and **NOI-MM-2** would reduce this impact to a less-than-significant level.

Alternative 5 – Direct Oversight with Farm Monitoring

Impact NOI-1. Exposure of Sensitive Land Uses to Noise from Construction Activities in Excess of Applicable Standards

Noise impacts from construction would result from installation of individual farm groundwater wells and implementation of management practices that require the use of heavy-duty equipment. Noise levels resulting from implementation of management practices are expected to be similar to those described for Alternative 2 (see **Impact NOI-1**). However, construction of individual farm groundwater wells and accessory facilities would generate increased noise levels from construction equipment, such as drill rigs.

As shown in Table 5.4-4, estimated noise levels from drill rigs are 79 dBA at 50 feet (Hoover & Keith 2008). The analysis of noise levels at various distances presented in Table 5.4-5 includes a drill rig and indicates the potential for drill rig operation to exceed local noise standards. Drill rigs are often required to operate continuously for 24 hours a day over several days, which increases the potential for nighttime noise standards to be exceeded. This impact is therefore considered potentially significant. Implementation of **Mitigation Measure NOI-MM-1** would reduce this impact to a less-than-significant level.

Impact NOI-2. Exposure of Sensitive Land Uses to Noise from Operational Activities in Excess of Applicable Standards

Operational noise impacts would result from vehicle trips made by the Central Valley Water Board to perform grower site inspections, as well as any pump motors associated with the groundwater or tailwater recovery system wells. In addition, trips made by growers to transport water samples to the laboratory for analysis may generate additional noise from vehicle use. As discussed above, increases in noise from vehicle travel are expected to be relatively minor. Similarly, noise generated from individual well pumps would be temporary and sporadic. Information on the types and number of pumps, as well as the number and distances of vehicle trips, is currently unavailable. Consequently, a quantitative analysis of noise impacts related to operations of Alternative 5 is not possible. Potential noise from unenclosed pumps located close to noise-sensitive uses could exceed local noise standards. This impact is therefore considered potentially significant. Implementation of **Mitigation Measures NOI-MM-1** and **NOI-MM-2** would reduce this impact to a less-than-significant level.

5.4.5 Mitigation and Improvement Measures

Mitigation Measure NOI-MM-1: Implement Noise-Reducing Construction Practices

Growers will implement noise-reducing construction practices such that noise from construction does not exceed applicable local noise standards or limits specified in the applicable county ordinances and general plan noise elements.

Mitigation Measure NOI-MM-2: Reduce Noise Generated by Individual Well Pumps

If well pumps are installed, growers will ensure that they are enclosed or located behind barriers such that noise does not exceed applicable local noise standards or limits specified in the applicable county ordinances and general plan noise elements.

5.5.1 Introduction

This section discusses the potential impacts of program alternatives on air quality. Specifically, it summarizes relevant federal, state, and local policies; describes existing environmental conditions in the program area with respect to air quality, and identifies potentially significant impacts that may result from implementation of program alternatives. Mitigation measures to avoid or reduce the identified impacts also are presented. Please refer to Section 5.6 for a discussion of global climate change and project-level carbon dioxide (CO_2) emissions.

5.5.2 Regulatory Framework

This section discusses federal, state, and local regulations related to air quality that may apply to the program alternatives.

The State of California established air pollution control programs before federal requirements were enacted. However, federal Clean Air Act (CAA) legislation in the 1970s resulted in a gradual merging of state and federal air quality programs, particularly those relating to industrial sources. Air quality management programs developed by California since the late 1980s have generally responded to requirements established by the federal CAA.

Amendments to the CAA (including the 1990 amendments known as the CAAA, which are the current governing regulations for air quality) have produced additional changes in the structure and administration of air quality management programs. The CAAA requires preparation of an air quality attainment plan for any area that violates state standards for carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), or ozone. Locally prepared attainment plans are not required for areas that violate the state standards for PM10 [particulate matter less than or equal to 10 microns in diameter], but the CARB is currently addressing PM10 attainment issues through expanded air quality monitoring, emissions inventory improvements, and comprehensive field studies.

The federal and state air quality management agencies of direct importance within the program area are EPA and ARB. In addition, 24 local air districts have jurisdiction over activities within the 36 counties included in the program area.[1] These districts, as well as their judicial boundaries, are identified in Figure 5.5-1. ARB and the local air districts are responsible for ensuring that state standards are met. The local air districts are responsible for implementing strategies for air quality improvement and recommending mitigation measures for new growth and development. The local air districts are responsible for establishing and enforcing local air quality rules and regulations that address the requirements of federal and state air quality laws.

[1] Small portions of Los Angeles and San Luis Obispo Counties are within the project boundary but have no irrigated lands as defined by the program. A small portion of land in Ventura County that is within the program boundary is identified as "pasture." However, potential impacts caused by the proposed program in Ventura County are beyond the scope of this document and are not included in the analysis.

California and the federal government have established standards for several different pollutants. For some pollutants, separate standards have been set for different measurement periods. Most standards have been set to protect public health. For some pollutants, standards have been based on other values (such as protection of crops, protection of materials, or avoidance of nuisance conditions). State and federal standards for a variety of pollutants are summarized in Table 5.5-1.

Federal

The CAA, enacted in 1963 and amended several times thereafter (including the 1990 amendments), establishes the framework for modern air pollution control. The CAA directs EPA to establish ambient air standards for six pollutants: ozone, CO, lead, NO_2, PM, and SO_2. The standards are divided into primary and secondary standards. Primary standards are designed to protect human health, including the health of “sensitive” populations such as asthmatics, children, and the elderly, within an adequate margin of safety. Secondary standards are designed to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The primary legislation that governs federal air quality regulations is the CAAA. The CAAA delegates primary responsibility for clean air to EPA. EPA develops rules and regulations to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

Areas that do not meet the federal ambient air quality standards are called *nonattainment* areas. For these nonattainment areas, the CAAA requires states to develop and adopt State Implementation Plans (SIPs), which are air quality plans showing how air quality standards will be attained. The SIP, which is reviewed and approved by EPA, must demonstrate how the federal standards will be achieved. Failing to submit a plan or secure approval could lead to denial of federal funding and permits for such improvements as highway construction and sewage treatment plants. In California, EPA has delegated authority to prepare SIPs to ARB, which, in turn, has delegated that authority to individual air districts. In cases where the SIP is submitted by the state but fails to demonstrate achievement of the standards, EPA is directed to prepare a federal implementation plan.

State

Responsibility for achieving California’s air quality standards, which are more stringent than federal standards, is placed on ARB and local air districts, and is to be achieved through district-level air quality management plans that will be incorporated into the SIP. As noted, EPA has delegated the authority to prepare SIPs in California to ARB, which in turn has delegated that authority to individual air districts.

ARB has traditionally established state air quality standards, maintained oversight authority in air quality planning, developed programs for reducing emissions from motor vehicles, developed air emission inventories, collected air quality and meteorological data, and approved SIPs.

Responsibilities of air districts include overseeing stationary source emissions, approving permits, maintaining emissions inventories, maintaining air quality stations, overseeing agricultural burning permits, and reviewing air quality–related sections of environmental documents required by CEQA.

The California Clean Air Act (CCAA) of 1988 substantially added to the authority and responsibilities of air districts. The CCAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation

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Figure 5.5-1
Affected Air Districts
Irrigated Lands Regulatory Program

control measures (TCMs). The CCAA focuses on attainment of the state ambient air quality standards, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The CCAA requires designation of attainment and nonattainment areas with respect to state ambient air quality standards. The CCAA also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for CO, SO_2, NO_2, or ozone. These Clean Air Plans are specifically designed to attain these standards and must be designed to achieve an annual 5-percent reduction in district-wide emissions of each nonattainment pollutant or its precursors. Where an air district is unable to achieve a 5-percent annual reduction in district-wide emissions of each nonattainment pollutant or its precursors, the adoption of "all feasible measures" on an expeditious schedule is acceptable as an alternative strategy (Health and Safety Code Section 40914[b][2]). No locally prepared attainment plans are required for areas that violate the state PM10 standards, but ARB is currently addressing PM10 attainment issues.

The CCAA requires that the state air quality standards be met as expeditiously as practicable but, unlike the federal CAA, does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

The CCAA emphasizes the control of "indirect and area-wide sources" of air pollutant emissions. The CCAA gives local air pollution control districts explicit authority to regulate indirect sources of air pollution and to establish TCMs. The CCAA does not define *indirect and area-wide sources*. However, Section 110 of the federal CAA defines an *indirect source* as

> a facility, building, structure, installation, real property, road, or highway, which attracts, or may attract, mobile sources of pollution. Such term includes parking lots, parking garages, and other facilities subject to any measure for management of parking supply.

TCMs are defined in the CCAA as "any strategy to reduce trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion for the purpose of reducing vehicle emissions."

Local

As previously indicated, there are 24 air districts of direct importance in the program area (Figure 5.5-1). These air districts have jurisdiction over activities within the 36 counties in the program area. The local air districts are responsible for implementing strategies for air quality improvement and recommending mitigation measures for new growth and development. At the local level, air quality is managed through land use and development planning practices, and is implemented through the general planning process. The local air districts are responsible for establishing and enforcing local air quality rules and regulations that address the requirements of federal and state air quality laws. Local air districts, counties within their jurisdiction, and applicable thresholds relevant to the program area are summarized in Table 5.5-2.

In addition to the thresholds presented in Table 5.5-2, site-specific projects may be subject to additional rules and regulations required by each of the local air districts. For more information on applicable rules and regulations, please see: http://www.arb.ca.gov/drdb/drdbltxt.htm.

Table 5.5-1. Ambient Air Quality Standards Applicable in California

Pollutant	Symbol	Average Time	Standard (parts per million) California	Standard (parts per million) National	Standard (micrograms per cubic meter) California	Standard (micrograms per cubic meter) National	Violation Criteria California	Violation Criteria National
Ozone*	O_3	1 hour	0.09	NA	180	NA	If exceeded	NA
		8 hours	0.070	0.075	137	147	If exceeded	If fourth highest 8-hour concentration in a year, averaged over 3 years, is greater than the standard
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
(Lake Tahoe only)		8 hours	6	NA	7,000	NA	If equaled or exceeded	NA
Nitrogen dioxide	NO_2	Annual arithmetic mean	0.030	0.053	57	100	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.18	0.100	339	NA	If exceeded	NA
Sulfur dioxide	SO_2	Annual arithmetic mean	NA	0.030	NA	80	NA	If exceeded
		24 hours	0.04	0.14	105	365	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.25	NA	655	NA	If exceeded	NA
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	If equaled or exceeded	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.01	NA	26	NA	If equaled or exceeded	NA
Inhalable particulate matter	PM10	Annual arithmetic mean	NA	NA	20	NA	If exceeded	NA
		24 hours	NA	NA	50	150	If exceeded	If exceeded on more than 1 day per year
	PM2.5	Annual arithmetic mean	NA	NA	12	15.0	If exceeded	If 3-year average of the weighted annual mean from single or multiple community-oriented monitors exceeds the standard
		24 hours	NA	NA	NA	35	NA	If less than 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard
Sulfate particles	SO_4	24 hours	NA	NA	25	NA	If equaled or exceeded	NA

Pollutant	Symbol	Average Time	Standard (parts per million) California	Standard (parts per million) National	Standard (micrograms per cubic meter) California	Standard (micrograms per cubic meter) National	Violation Criteria California	Violation Criteria National
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	If exceeded no more than 1 day per year
		30-day average	NA	NA	1.5	NA	If equaled or exceeded	NA
		Rolling 3-Month average	NA	NA	NA	0.15	NA	Averaged over a rolling 3-month period

Notes:
National standards shown are the primary (public health) standards.
All equivalent units are based upon a reference temperature of 25°C and a reference pressure of 760 torr; *ppm* in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
NA = not applicable.
* The U.S. Environmental Protection Agency (EPA) recently replaced the 1-hour ozone standard with an 8-hour standard of 0.08 part per million. EPA issued a final rule that revoked the 1-hour standard on June 15, 2005. However, the California 1-hour ozone standard will remain in effect.
Source: ARB 2008a.

Table 5.5-2. Air Districts and Counties Affected by Program Alternatives and Associated Significance Thresholds

Air District	Air Basin	Affected Counties	Threshold Type	ROG	NO_X	PM10	CO
Amador County APCD	Mountain Counties	Amador	Construction	N/A	N/A	N/A [a]	N/A
			Operational	N/A	N/A	N/A	N/A
BAAQMD[c]	San Francisco Bay	Napa ,Contra Costa, Alameda, Solano	Construction	N/A	N/A	N/A[b]	N/A
			Operational	80 lbs/day	80 lbs/day	80 lbs/day	550 lbs/day
Butte County AQMD[d]	Sacramento Valley	Butte	Construction	N/A[e]	N/A[e]	N/A[e]	N/A[e]
			Operational	137 lbs/day	137 lbs/day	137 lbs/day	N/A
Calaveras County APCD	Mountain Counties	Calaveras	Construction	N/A	N/A	N/A	N/A
			Operational	N/A	N/A	N/A	N/A
Colusa County APCD	Sacramento Valley	Colusa	Construction	25 lbs/day	25 lbs/day	80 lbs/day	500 lbs/day
			Operational	25 lbs/day	25 lbs/day	80 lbs/day	500 lbs/day
El Dorado County AQMD	Mountain Counties	El Dorado	Construction	82 lbs/day[f]	82 lbs/day[f]	N/A[g]	CAAQS
			Operational	82 lbs/day	82 lbs/day	N/A	CAAQS
Feather River AQMD	Sacramento Valley	Sutter, Yuba	Construction	N/A[h]	N/A[h]	N/A[h]	N/A[h]

Air District	Air Basin	Affected Counties	Threshold Type	ROG	NO_X	PM10	CO
			Operational	25 lbs/day[i]	25 lbs/day[i]	80 lbs/day[i]	N/A
Glenn County APCD	Sacramento Valley	Glenn	Construction	N/A[j]	N/A[j]	N/A[j]	N/A[j]
			Operational	N/A[j]	N/A[j]	N/A[j]	N/A[j]
Great Basin Unified APCD	Great Basin Valley	Alpine	Construction	N/A	N/A	N/A[k]	N/A
			Operational	N/A	N/A	N/A	N/A
Kern County APCD	Mojave Desert	Kern	Construction	25 tons/year	25 ton/year	15 tons/year	CAAQS
			Operational	25 tons/year	25 tons/year	15 tons/year	CAAQS
Lake County AQMD	Lake County	Lake	Construction	150 lbs/day[l]	150 lbs/day[l]	150 lbs/day[l]	1,500 lbs/day[l]
			Operational	80 lbs/day[m]	80 lbs/day[m]	80 lbs/day[m]	550 lbs/day[m]
Lassen County APCD	Northeast Plateau	Lassen	Construction	N/A	N/A	N/A	N/A
			Operational	N/A	N/A	N/A	N/A
Mariposa County APCD	Mountain Counties	Mariposa	Construction	100 tons/yr	100 tons/yr	100 tons/yr	100 tons/yr
			Operational	100 ton/yr	100 ton/yr	100 tons/yr	100 tons/yr
Modoc County APCD	Northeast Plateau	Modoc	Construction	N/A[n]	N/A[n]	N/A[n]	N/A[n]
			Operational	N/A[n]	N/A[n]	N/A[n]	N/A[n]
Monterey Bay Unified APCD	North Central Coast	San Benito	Construction	N/A[o]	N/A[o]	82 lbs/day	N/A
			Operational	137 lbs/day	137 lbs/day	82 lbs/day	550 lb/day
Northern Sierra AQMD	Mountain Counties	Plumas, Sierra, Nevada	Construction	≤ 137 lbs/day	≤ 137 lbs/day	≤ 137 lbs/day[p]	N/A
			Operational	≤ 137 lbs/day	≤ 137 lbs/day	≤ 137 lbs/day	N/A
Placer County APCD	Mountain Counties, Sacramento Valley	Placer	Construction	82 lbs/day	82 lbs/day	82 lbs/day	550 lbs/day[q]
			Operational	82 lbs/day	82 lbs/day	82 lbs/day	550 lbs/day[q]
Sacramento Metropolitan AQMD	Sacramento Valley	Sacramento	Construction	N/A	85 lbs/day	CAAQS	CAAQS
			Operational	65 lbs/day	65 lbs/day	CAAQS	CAAQS
San Joaquin Valley APCD	San Joaquin Valley	San Joaquin, Stanislaus, Merced, Fresno, Kings, Kern, Madera, Tulare	Construction	10 tons/year	10 tons/year	N/A[r]	CAAQS
			Operational	10 tons/year	10 tons/year	15 tons/year	CAAQS
Shasta County AQMD	Sacramento Valley	Shasta	Construction	137 lbs/day	137 lbs/day	137 lbs/day	CAAQS
			Operational	137 lbs/day	137 lbs/day	137 lbs/day	CAAQS
Siskiyou County APCD	Northeast Plateau	Siskiyou	Construction	N/A	N/A	N/A	N/A

Air District	Air Basin	Affected Counties	Threshold Type	ROG	NO_X	PM10	CO
			Operational	N/A	N/A	N/A	N/A
Tehama County APCD	Sacramento Valley	Tehama	Construction	137 lbs/day[s]	137 lbs/day[s]	137 lbs/day[s]	N/A
			Operational	137 lbs/day[s]	137 lbs/day[s]	137 lbs/day[s]	N/A
Tuolumne County APCD	Mountain Counties	Tuolumne	Construction	1,000 lbs/day	1,000 lbs/day	1,000 lbs/day	1,000 lbs/day
			Operational	1,000 lbs/day	1,000 lbs/day	1,000 lbs/day	1,000 lbs/day
Yolo-Solano AQMD	Sacramento Valley, San Francisco Bay	Yolo, Solano	Construction	10 tons/year	10 tons/year	80 lbs/day	CAAQS
			Operational	10 tons/year	10 tons/year	80 lbs/day	CAAQS

Notes:

APCD = Air Pollution Control District.
AQMD = Air Quality Management District.
BAAQMD = Bay Area Air Quality Management District.
CAAQS = California Ambient Air Quality Standards.
N/A = not applicable.
ROG = reactive organic gases.
NO_X = oxides of nitrogen.
CO = carbon monoxide.
lbs/day = pounds per day.
Qtr = quarter

[a] Although Amador County APCD does not have quantitative thresholds for PM10 emissions, projects must comply with Rule 218, *Fugitive Dust Emissions*. Good housekeeping practices can be found on page 2 of Rule 218.

[b] Construction emissions of PM10 will result in no adverse effects with implementation of the applicable control measures found in Table 2, *Feasible Control Measures for Construction Emissions of PM10* (Page 15), of the BAAQMD California Environmental Quality Act Guidelines.

[c] In their September 2009 draft Air Quality Guidelines, the BAAQMD proposed updated operational and construction emissions thresholds. Proposed thresholds for emissions from construction activities and project operations are 54 lbs/day of ROG, NO_X, and PM2.5, and 82 lbs/day of PM10. The PM10 and PM2.5 thresholds for construction emissions apply only to vehicle exhaust. Proposed thresholds for CO is the exceedance of ambient air quality standards.

[d] District staff has indicated that operational thresholds for ozone and PM10 and PM2.5 will be lowered sometime in 2010. In addition, independent thresholds for construction activities will be established.

[e] Operational emission thresholds apply to construction if construction will last more than 1 year.

[f] The threshold of 82 lbs/day is a combined total. Therefore, one pollutant can be in excess of 82 lbs/day, but as long as the combined total is below 164 lbs/day, the impact is considered less than significant.

[g] Although El Dorado AQMD does not have quantitative thresholds for PM10 emissions, it requires implementation of effective and comprehensive feasible control measures to reduce emissions. According to the El Dorado AQMD, implementation of Rule 223-1 will reduce fugitive dust emission from construction to less-than-significant levels.

[h] The Feather River AQMD does not require quantification of construction emissions. Instead, the District requires that all projects comply with the standard mitigation measures.

[i] Applies to construction activities lasting longer than 12 months.

[j] Although the Glenn County APCD does not have specific construction and operational emission thresholds, they require water trucks onsite during construction, and they require any earth-moving activities to be suspended during wind events exceeding 15 miles per hour.

[k] Although the Great Basin APCD has no established thresholds for PM10, it requires implementation of Rule 401—*Fugutive Dust*.

[l] Lake County AQMD staff recommend utilizing the more stringent of the following: The BAAQMD thresholds for determining significance or the Lake County AQMD New Source Review (NSR) thresholds. Since the BAAQMD does not require quantification of construction emissions, the thresholds shown are from the NSR. According to Lake County AQMD staff, even if emissions do not exceed these thresholds, some mitigation of impacts should be included and/or considered for the project.

[m] Since the BAAQMD thresholds are more stringent than the Lake County AQMD NSR thresholds, they should be used to determine significance of operational impacts.

[n] The Modoc County APCD does not have blanket thresholds for construction and operational emissions. According to the district staff, the Modoc County APCD should be contacted on a per-project basis to obtain applicable thresholds of significance.

[o] The Monterey Bay APCD does not require the quantification of construction-related ozone precursors (i.e., ROG or NO_X), as they are accommodated in the emission inventories of state and federally required air plans.

[p] If more than 1 acre is altered or natural ground cover removed, the program proponent must comply with Rule 226 and submit a dust control plan.

[q] If CO thresholds are exceeded, modeling can be done to demonstrate that state and federal criteria will not be exceeded.

[r] Compliance with District Regulation VIII, including implementation of all feasible control measures specified in the *Guide for Assessing Air Quality Impacts*, constitutes sufficient mitigation to reduce construction-related PM10 emissions to less-than-significant levels.

[s] Tehama County APCD does not have significance thresholds but recommends using the Action Level Thresholds used in Butte and Shasta Counties. The threshold shown is the Level C Threshold. In addition, if a project will be moving earth in excess of 2,000 cubic yards (yd^3), the District requires (at minimum) a Fugitive Dust Permit. If a project will be moving 10,000 yd^3 or more of earth, it is considered a large project and requires consultation with the District before proceeding.

Sources: Amador County APCD 2000; Barber pers. comm.; BAAQMD 1999, 2009; Beck pers. comm.; Bertotti pers. comm.; Butte County AQMD 2008; Cadrett pers. comm.; Chang pers. comm.; County of Tuolumne 2000; Conway pers. comm.; El Dorado County APCD 2002; Feather River AQMD n.d., 2009; Gearhart pers. comm.; Grewal pers. comm.; Gomez pers. comm.; Haas pers. comm.; Kern County Planning Department 2004; Lake County AQMD 2006; Ledbetter pers. comm.; Monterey Bay APCD 2004; Northern Sierra AQMD 2000; Otani pers. comm.; Sacramento Metropolitan AQMD 2004; San Joaquin Valley Unified APCD 2002; Schade pers. comm.; Shasta County 2004; Sunday pers. comm.; Waldrop pers. comm.; Williams pers. comm.; Yolo-Solano AQMD 2007.

5.5.3 Environmental Setting

California is divided into 15 air basins to better manage air pollution. The program area encompasses the following 11 air basins: Mountain Counties (MCAB), Sacramento Valley (SVAB), San Joaquin Valley (SJVAB), Lake County (LCAB), Great Basin Valley (GBVAB), San Francisco Bay Area (SFBAAB), Northeast Plateau (NPAB), North Central Coast (NCCAB), South Central Coast (SCCAB), South Coast (SCAB), and Mojave Desert (MDAB) (see Table 5.5-2). The majority of farms, and thus potential emission sources, are located in the MCAB, SVAB, and SJVAB.

Regional Climate and Meteorology

The primary factors that determine air quality are the locations of air pollutant sources and the amount of pollutants emitted from those sources. Meteorological and topographical conditions are also important—atmospheric conditions, such as wind speed, wind direction, and air temperature gradients, interact with the physical features of the landscape to determine the movement and dispersal of air pollutants. In regard to the air basins discussed above, climate and meteorology vary within each. Since the majority of the program's acreage is located in the MCAB, SVAB, and SJVAB, the following section discusses climate and meteorological information associated with these three basins.

Mountain Counties Air Basin

Within the MCAB, the general climate of the region varies based on elevation and proximity to the Sierra Nevada. Due to the complex features of terrain within the basin, it is possible for various climate types to exist in proximity to one another. This can be attributed to the varying patterns of mountains and hills in the basin, which result in wide variations in temperature, rainfall, and localized wind in the basin.

Areas near the Sierra Nevada are generally subject to storms moving westerly from the Pacific in winter, which results in large amounts of precipitation. During summer, precipitation is much lighter, with intermittent precipitation flowing from the south. Precipitation is generally higher near the mountain areas and decline moving westerly toward the lower areas. Rain shadow effects can vary precipitation levels between areas in proximity to one another. During winter, mountain temperatures can drop below freezing for extended periods, with high accumulations of snow; while winter temperatures in the western foothill regions usually drop below freezing at night, and precipitation is often a mixture of rain and light snow. During summer, mountain temperatures are often mild, with daytime highs in the 70s to low 80s degrees Fahrenheit (°F), while temperatures in the lower elevations often experience highs in the upper 90s°F.

Within the MCAB, meteorology and topography combine so that local conditions predominate in determining the effect of emissions in the basin. Air quality is affected by regional flow patterns, which direct pollutants downwind of polluting sources. In addition, topographical features, such as the surrounding mountain ranges, and localized meteorological conditions, such as shallow vertical mixing and light winds, create areas of high pollutant concentrations by hindering their dispersal. Inversion layers frequently occur in small valleys and trap pollutants close to the ground. This can lead to increased CO levels ("hotspots") along heavily traveled roads and at busy intersections during winter. During summer, longer daylight hours, high temperatures, and stagnant air provide conditions suitable for the formation of ozone through the photochemical reaction between reactive organic gases (ROG) and oxides of nitrogen (NO_X).

Sacramento Valley Air Basin

The SVAB has a Mediterranean climate characterized by hot, dry summers and cool, rainy winters. During winter, the North Pacific storm track intermittently dominates valley weather, and fair weather alternates with periods of extensive clouds and precipitation. Also characteristic of winter weather in the valley are periods of dense and persistent low-level fog, which is most prevalent between storms. The frequency and persistence of heavy fog in the valley diminish with the approach of spring. The average yearly temperature range for the Sacramento Valley is between 20 and 115°F, with summer high temperatures often exceeding 90°F and winter low temperatures occasionally dropping below freezing.

Prevailing wind in the Sacramento Valley is generally from the southwest due to marine breezes flowing through the Carquinez Strait, which is the major corridor for air moving into the Sacramento Valley from the west. Incoming airflow strength varies daily, with a pronounced diurnal cycle. Influx strength is weakest in the morning and increases in the evening hours. Associated with the influx of air through the Carquinez Strait is the Schultz Eddy, which is formed when mountains on the valley's western side divert incoming marine air. The eddy contributes to the formation of a low-level southerly jet between 500 and 1,000 feet above the surface that is capable of speeds in excess of 35 miles per hour (mph). This jet is important for air quality in the Sacramento Valley because of its ability to transport air pollutants over large distances.

The SVAB's climate and topography contribute to the formation and transport of photochemical pollutants throughout the region. The region experiences temperature inversions that limit atmospheric mixing and trap pollutants; high pollutant concentrations result near the ground surface. Generally, the lower the inversion base height from the ground and the greater the temperature increase from base to top, the more pronounced the inhibiting effect of the inversion will be on pollutant dispersion. Consequently, the highest concentrations of photochemical pollutants occur from late spring to early fall, when photochemical reactions are greatest because of intensifying sunlight and lowering altitude of daytime inversion layers. Surface inversions (those at altitudes of 0–500 feet above sea level) are most frequent during winter, and subsidence inversions (those at 1,000–2,000 feet above sea level) are most common in summer.

San Joaquin Valley Air Basin

The SJVAB is bounded by the Sierra Nevada to the east (8,000–14,000 feet in elevation), the Coast Ranges to the west (averaging 3,000 feet in elevation), and the Tehachapi Mountains to the south (6,000–8,000 feet in elevation). The area's climate is considered "inland Mediterranean" and is characterized by warm, dry summers and cool winters. Summer high temperatures often exceed 100°F, averaging in the low 90s in the northern valley and high 90s in the southern portion.

Although marine air generally flows into the basin from the Delta, the surrounding mountain ranges restrict air movement through and out of the valley. Wind speed and direction influence the dispersion and transportation of ozone precursors, PM10, and CO—the more wind flow, the less accumulation of these pollutants.

The vertical dispersion of air pollutants in the SJVAB is limited by the presence of persistent temperature inversion (warm air over cool air). Due to differences in air density, the air above and below the inversion do not mix. Ozone and its precursors will mix and react to produce higher concentrations under an inversion and will trap directly emitted pollutants like CO.

Precipitation and fog tend to reduce pollutant concentrations. Ozone needs sunlight for its formation, and clouds and fog block the required radiation. Because CO is slightly water-soluble, precipitation and fog tend to “reduce” CO concentrations in the atmosphere. PM10 is somewhat “washed” from the atmosphere with precipitation. Precipitation in the San Joaquin Valley decreases from north to south, with approximately 20 inches in the north, 10 inches in the middle, and less than 6 inches in the south.

Criteria Pollutants

The federal and state governments have established ambient air quality standards for the following six criteria pollutants: ozone, CO, NO_2, SO_2, PM10, PM2.5 [particulate matter smaller than 2.5 microns or less in diameter], and lead. Ozone, NO_2, and particulate matter are generally considered to be “regional” pollutants, as these pollutants or their precursors affect air quality on a regional scale. Pollutants such as CO, SO_2, lead, and particulate matter are considered to be local pollutants that tend to accumulate in the air locally. Particulate matter is considered to be a localized pollutant as well as a regional pollutant. Within the program area, ozone, CO, PM10, and PM2.5 are of greatest concern. Toxic air contaminants (TACs) also are pollutants of concern, although no state or federal ambient air quality standards exist for these pollutants. Brief descriptions of these pollutants are provided below, and a complete summary of state and national ambient air quality standards (CAAQS and NAAQS, respectively) is provided in Table 5.5-1.

Ozone

Ozone is a respiratory irritant that increases susceptibility to respiratory infections. It is also an oxidant that can cause substantial damage to vegetation and other materials.

Ozone is not emitted directly into the air but is formed by a photochemical reaction in the atmosphere. Ozone precursors (ROG and NO_X) react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. Off-road agricultural equipment contributes to statewide NO_X emissions. ARB is committed to developing measures to “accelerate fleet turnover to equipment with engines meeting cleaner NO_X and PM standards” (ARB 2008b).

State and federal standards for ozone have been set for 1- and 8-hour averaging times. The state 1-hour ozone standard is 0.09 parts per million (ppm), not to be exceeded. EPA recently replaced the 1-hour ozone standard with an 8-hour standard of 0.075 ppm. However, the California 1-hour standard will remain in effect. The state 8-hour standard is 0.070 ppm, not to be exceeded.

Carbon Monoxide

Carbon monoxide is a public health concern because it combines readily with hemoglobin and reduces the amount of oxygen transported in the bloodstream. Carbon monoxide can cause health problems such as fatigue, headache, confusion, dizziness, and even death.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter, when periods of light winds combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

State and federal CO standards have been set for 1- and 8-hour averaging times. The state 1-hour standard is 20 ppm, not to be exceeded, whereas the federal 1-hour standard is 35 ppm, not to be exceeded more than 1 day per year. The state 8-hour standard is 9.0 ppm, while the federal standard is 9 ppm. This means that a monitored 8-hour CO concentration from 9.1 to 9.4 ppm violates the state but not the federal standard.

Inhalable Particulates

Particulates can damage human health and retard plant growth. Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates also reduce visibility and corrode materials. Particulate emissions are generated by a wide variety of sources, including agricultural activities, industrial operations, vehicles (e.g., dust suspended by vehicle traffic and construction equipment), and secondary aerosols (formed by reactions in the atmosphere).

The state PM10 standards are 50 micrograms per cubic meter ($\mu g/m^3$) as a 24-hour average and 20 $\mu g/m^3$ as an annual arithmetic mean. The federal PM10 standards are 150 $\mu g/m^3$ as a 24-hour average. The federal PM2.5 standards are 15 $\mu g/m^3$ for the annual average and 35 $\mu g/m^3$ for the 24-hour average. The state PM2.5 standard is 12 $\mu g/m^3$ for the annual arithmetic mean.

Toxic Air Contaminants/Hazardous Air Pollutants

TACs and hazardous air pollutants (HAPs) are pollutants that may result in an increase in mortality or serious illness, or that may pose a present or potential hazard to human health. The CAA identified 188 pollutants as being air toxics. Air toxics are referred to as HAPs under the CAA and are referred to as TACs under the CCAA. Health effects of TACs include cancer, birth defects, neurological damage, damage to the body's natural defense system, and diseases that lead to death.

In 1998, following a 10-year scientific assessment process, ARB identified particulate matter from diesel-fueled engines as a TAC. In the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles,* ARB said that "Compared to other air toxics ARB has identified and controlled, diesel particulate matter emissions are estimated to be responsible for about 70 percent of the total ambient air toxics risk" (ARB 2000).

A number of pesticides have been identified as TACs. DPR is responsible for evaluation and regulation of pesticides identified as TACs. Following DPR's determination of a pesticide as a TAC, the compound is formally listed, and appropriate control and mitigation measures are developed (DPR 2009).

Asbestos is another federally recognized TAC of concern. Naturally occurring asbestos (NOA), or ultramaif serpentinized rock closely associated with asbestos, is known to be located within several program areas. Asbestos can adversely affect humans only in its fibrous form; these fibers must be broken and dispersed into the air and then inhaled. During the geological process or through earth-moving processes (e.g., construction), the asbestos mineral found in NOA can be crushed, causing it to become airborne. Constant exposure to asbestos at high levels on a regular basis may cause cancer in humans.

Local Area Monitoring Data

Existing conditions for air quality in the program area can be further described with summary statistics for criteria air pollutants. Tables 5.5-3, 5.5-4, and 5.5-5 summarize monitoring data for criteria air pollutant levels from all monitoring stations in the MCAB, SVAB, and SJVAB, respectively. These numbers represent air quality monitoring data for the last 3 years (2006–2008) for which complete data are available.

Table 5.5-3. Ambient Air Quality Monitoring Data for the Mountain Counties Air Basin

Pollutant Standards	2006	2007	2008
1-Hour Ozone			
Maximum 1-hour concentration (ppm)	0.134	0.115	0.149
1-hour California designation value	0.14	0.12	0.13
1-hour expected peak day concentration	–	–	–
Number of days standard exceeded[a]			
CAAQS 1-hour (>0.09 ppm)	50	19	34
8-Hour Ozone			
National maximum 8-hour concentration (ppm)	0.115	0.106	0.118
National second-highest 8-hour concentration (ppm)	0.111	0.099	0.114
State maximum 8-hour concentration (ppm)	0.116	0.107	0.118
State second-highest 8-hour concentration (ppm)	0.111	0.100	0.115
8-hour national designation value	0.097	0.096	0.098
8-hour California designation value	0.124	0.108	0.114
8-hour expected peak day concentration	–	–	–
Number of days standard exceeded[a]			
NAAQS 8-hour (>0.075 ppm)	88	57	59
CAAQS 8-hour (>0.070 ppm)	103	88	84
Carbon Monoxide (CO)			
National[b] maximum 8-hour concentration (ppm)	0.58	0.68	–
National[b] second-highest 8-hour concentration (ppm)	0.40	0.59	–
California[c] maximum 8-hour concentration (ppm)	0.58	0.68	–
California[c] second-highest 8-hour concentration (ppm)	0.40	0.57	–
Maximum 1-hour concentration (ppm)	–	–	–
Second-highest 1-hour concentration (ppm)	–	–	–
Number of days standard exceeded[a]			
NAAQS 8-hour (≥9 ppm)	0	0	0
CAAQS 8-hour (≥9.0 ppm)	0	0	0
NAAQS 1-hour (≥35 ppm)	0	0	0
CAAQS 1-hour (≥20 ppm)	0	0	0
Particulate Matter (PM10)[d]			
National[b] maximum 24-hour concentration (μg/m³)	167.1	127.0	135.7
National[b] second-highest 24-hour concentration (μg/m³)	107.7	51.0	77.3
State[c] maximum 24-hour concentration (μg/m³)	97.0	116.0	118.4
State[c] second-highest 24-hour concentration (μg/m³)	67.0	45.0	66.3
State annual average concentration (μg/m³)[e]	17.6	16.3	15.8
National annual average concentration (μg/m³)	29.0	24.1	23.8

Pollutant Standards	2006	2007	2008
Number of days standard exceeded[a]			
NAAQS 24-hour (>150 μg/m³)[f]	–	–	–
CAAQS 24-hour (>50 μg/m³)[f]	0	0	6
Particulate Matter (PM2.5)			
National[b] maximum 24-hour concentration (μg/m³)	–	–	–
National[b] second-highest 24-hour concentration (μg/m³)	–	–	–
State[c] maximum 24-hour concentration (μg/m³)	–	–	–
State[c] second-highest 24-hour concentration (μg/m³)	–	–	–
National annual designation value (μg/m³)	–	–	–
National annual average concentration (μg/m³)	–	–	–
State annual designation value (μg/m³)	–	–	–
State annual average concentration (μg/m³)[e]	–	–	–
Number of days standard exceeded[a]			
NAAQS 24-hour (>35 μg/m³)	–	–	–

Notes: CAAQS = California ambient air quality standards.
NAAQS = national ambient air quality standards.
– = insufficient data available to determine the value.

[a] An exceedance is not necessarily a violation.

[b] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.

[c] State statistics are based on local conditions data, except in the South Coast Air Basin, for which statistics are based on standard conditions data. In addition, State statistics are based on California-approved samplers.

[d] Measurements usually are collected every 6 days.

[e] State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[f] Mathematical estimate of how many days concentrations would have been measured as higher than the level of the standard, had each day been monitored. Values have been rounded.

Sources: ARB 2009a; EPA 2009a.

Table 5.5-4. Ambient Air Quality Monitoring Data for the Sacramento Valley Air Basin

Pollutant Standards	2006	2007	2008
1-Hour Ozone			
Maximum 1-hour concentration (ppm)	0.143	0.138	0.166
1-hour California designation value	0.13	0.13	0.14
1-hour expected peak day concentration	–	–	–
Number of days standard exceeded[a]			
CAAQS 1-hour (>0.09 ppm)	44	15	42
8-Hour Ozone			
National maximum 8-hour concentration (ppm)	0.114	0.122	0.123
National second-highest 8-hour concentration (ppm)	0.112	0.097	0.116
State maximum 8-hour concentration (ppm)	0.115	0.123	0.123
State second-highest 8-hour concentration (ppm)	0.112	0.097	0.116
8-hour national designation value	0.097	0.098	0.102
8-hour California designation value	0.112	0.112	0.116

Pollutant Standards	2006	2007	2008
8-hour expected peak day concentration	–	–	–
Number of days standard exceeded[a]			
NAAQS 8-hour (>0.075 ppm)	68	34	56
CAAQS 8-hour (>0.070 ppm)	88	61	79
Carbon Monoxide (CO)			
National[b] maximum 8-hour concentration (ppm)	4.19	5.58	2.84
National[b] second-highest 8-hour concentration (ppm)	3.51	4.10	2.74
California[c] maximum 8-hour concentration (ppm)	4.19	5.58	2.84
California[c] second-highest 8-hour concentration (ppm)	3.51	3.20	2.74
Maximum 1-hour concentration (ppm)	3.50	3.50	2.38
Second-highest 1-hour concentration (ppm)	3.15	3.23	2.23
Number of days standard exceeded[a]			
NAAQS 8-hour (≥9 ppm)	0	0	0
CAAQS 8-hour (≥9.0 ppm)	0	0	0
NAAQS 1-hour (≥35 ppm)	0	0	0
CAAQS 1-hour (≥20 ppm)	0	0	0
Particulate Matter (PM10)[d]			
National[b] maximum 24-hour concentration (μg/m³)	159.6	119.0	354.0
National[b] second-highest 24-hour concentration (μg/m³)	101.8	60.4	56.0
State[c] maximum 24-hour concentration (μg/m³)	111.0	119.0	355.0
State[c] second-highest 24-hour concentration (μg/m³)	71.0	65.2	58.0
State annual average concentration (μg/m³)[e]	28.8	28.1	33.4
National annual average concentration (μg/m³)	37.8	27.5	47.5
Number of days standard exceeded[a]			
NAAQS 24-hour (>150 μg/m³)[f]	–	–	–
CAAQS 24-hour (>50 μg/m³)[f]	53	36	69
Particulate Matter (PM2.5)			
National[b] maximum 24-hour concentration (μg/m³)	–	–	–
National[b] second-highest 24-hour concentration (μg/m³)	–	–	–
State[c] maximum 24-hour concentration (μg/m³)	–	–	–
State[c] second-highest 24-hour concentration (μg/m³)	–	–	–
National annual designation value (μg/m³)	–	–	–
National annual average concentration (μg/m³)	–	–	–
State annual designation value (μg/m³)	–	–	–
State annual average concentration (μg/m³)[e]	–	–	–
Number of days standard exceeded[a]			
NAAQS 24-hour (>35 μg/m³)	–	–	–

Pollutant Standards	2006	2007	2008

Notes: CAAQS = California ambient air quality standards.
NAAQS = national ambient air quality standards.
– = insufficient data available to determine the value.

[a] An exceedance is not necessarily a violation.

[b] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.

[c] State statistics are based on local conditions data, except in the South Coast Air Basin, for which statistics are based on standard conditions data. In addition, State statistics are based on California-approved samplers.

[d] Measurements usually are collected every 6 days.

[e] State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[f] Mathematical estimate of how many days concentrations would have been measured as higher than the level of the standard, had each day been monitored. Values have been rounded.

Sources: ARB 2009a, EPA 2009a.

Table 5.5-5. Ambient Air Quality Monitoring Data for the San Joaquin Valley Air Basin

Pollutant Standards	2006	2007	2008
1-Hour Ozone			
Maximum 1-hour concentration (ppm)	0.141	0.138	0.157
1-hour California designation value	0.14	0.14	0.15
1-hour expected peak day concentration	–	–	–
Number of days standard exceeded[a]			
CAAQS 1-hour (>0.09 ppm)	90	69	95
8-Hour Ozone			
National maximum 8-hour concentration (ppm)	0.121	0.110	0.132
National second-highest 8-hour concentration (ppm)	0.119	0.109	0.130
State maximum 8-hour concentration (ppm)	0.122	0.110	0.132
State second-highest 8-hour concentration (ppm)	0.120	0.109	0.130
8-hour national designation value	0.110	0.107	0.108
8-hour California designation value	0.117	0.120	0.124
8-hour expected peak day concentration	–	–	–
Number of days standard exceeded[a]			
NAAQS 8-hour (>0.075 ppm)	120	110	127
CAAQS 8-hour (>0.070 ppm)	141	138	150
Carbon Monoxide (CO)			
National[b] maximum 8-hour concentration (ppm)	3.73	3.16	2.34
National[b] second-highest 8-hour concentration (ppm)	3.65	2.95	2.14
California[c] maximum 8-hour concentration (ppm)	3.73	3.16	2.34
California[c] second-highest 8-hour concentration (ppm)	3.65	2.95	2.14
Maximum 1-hour concentration (ppm)	4.65	3.62	2.87
Second-highest 1-hour concentration (ppm)	4.12	3.4	2.52
Number of days standard exceeded[a]			
NAAQS 8-hour (≥9 ppm)	0	0	0
CAAQS 8-hour (≥9.0 ppm)	0	0	0
NAAQS 1-hour (≥35 ppm)	0	0	0

Pollutant Standards	2006	2007	2008
CAAQS 1-hour (≥20 ppm)	0	0	0
Particulate Matter (PM10)[d]			
National[b] maximum 24-hour concentration (μg/m³)	304.0	172.1	390.3
National[b] second-highest 24-hour concentration (μg/m³)	162.3	104.5	338.1
State[c] maximum 24-hour concentration (μg/m³)	255.0	135.0	353.5
State[c] second-highest 24-hour concentration (μg/m³)	188.0	116.2	125.6
State annual average concentration (μg/m³)[e]	56.5	48.5	56.0
National annual average concentration (μg/m³)	55.4	54.8	59.7
Number of days standard exceeded[a]			
NAAQS 24-hour (>150 μg/m³)[f]	4	1	5
CAAQS 24-hour (>50 μg/m³)[f]	167	145	182
Particulate Matter (PM2.5)			
National[b] maximum 24-hour concentration (μg/m³)	–	–	–
National[b] second-highest 24-hour concentration (μg/m³)	–	–	–
State[c] maximum 24-hour concentration (μg/m³)	–	–	–
State[c] second-highest 24-hour concentration (μg/m³)	–	–	–
National annual designation value (μg/m³)	–	–	–
National annual average concentration (μg/m³)	–	–	–
State annual designation value (μg/m³)	–	–	–
State annual average concentration (μg/m³)[e]	–	–	–
Number of days standard exceeded[a]			
NAAQS 24-hour (>35 μg/m³)	–	–	–

Notes: CAAQS = California ambient air quality standards.
NAAQS = national ambient air quality standards.
– = insufficient data available to determine the value.

[a] An exceedance is not necessarily a violation.

[b] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.

[c] State statistics are based on local conditions data, except in the South Coast Air Basin, for which statistics are based on standard conditions data. In addition, State statistics are based on California-approved samplers.

[d] Measurements usually are collected every 6 days.

[e] State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[f] Mathematical estimate of how many days concentrations would have been measured as higher than the level of the standard, had each day been monitored. Values have been rounded.

Sources: ARB 2009a, EPA 2009a.

As indicated in Table 5.5-3, the MCAB has experienced 204 violations of the national 8-hour ozone standard during the 3-year monitoring period. There were no reported violations of the national 1-hour or 8-hour CO standards. The MCAB has experienced 103 violations of the state 1-hour ozone standard, 275 violations of the state 8-hour ozone standard, and 6 violations of the state PM10 standard during the 3-year monitoring period. There have been no violations of the state 8-hour CO standard.

As indicated in Table 5.5-4, the SVAB has experienced 158 violations of the national 8-hour ozone standard during the 3-year monitoring period. There were no reported violations of the national 1-hour or 8-hour CO standards. The SVAB has experienced 101 violations of the state 1-hour ozone standard, 228 violations of the state 8-hour ozone standard, and 158 violations of the state PM10 standard during the 3-year monitoring period. There have been no violations of the state 8-hour CO standard.

As indicated in Table 5.5-5, the SJVAB has experienced 357 violations of the national 8-hour ozone standard and 10 violations of the federal PM10 standard over the 3-year monitoring period. There have been no violations of the national 1- hour or 8-hour CO standards.

Attainment Status

If monitored pollutant concentrations meet state or federal standards over a designated period of time, the area is classified as being in attainment for that pollutant. If concentrations violate the standards, the area is considered a nonattainment area for that pollutant. If data are insufficient to determine whether a pollutant is violating the standard, the area is designated as unclassified. If monitored pollutant concentrations violated the standards in the past but are no longer in violation, the area is considered a maintenance area.

As stated above, the program area includes all or part of 36 counties. Table 5.5-6 summarizes the national and state criteria pollutant attainment status for these counties.

Table 5.5-6. Criteria Pollutant Attainment Status in the Program Area

County	Pollutant	National	State
Alameda	1-hour Ozone[a]	N/A	Serious Nonattainment
	8-hour Ozone	Marginal Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Alpine	1-hour Ozone[a]	N/A	Unclassified
	8-hour Ozone	Unclassified/Attainment	Unclassified
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Amador	1-hour Ozone[a]	N/A	Nonattainment
	8-hour Ozone	Former Subpart 1[b]	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Unclassified
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Butte	1-hour Ozone[a]	N/A	Moderate Nonattainment
	8-hour Ozone	Former Subpart 1 (P)[c]	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Unclassified/Attainment	Nonattainment

County	Pollutant	National	State
	PM2.5	Nonattainment (P)	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Calaveras	1-hour Ozone[a]	N/A	Nonattainment
	8-hour Ozone	Former Subpart 1	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Colusa	1-hour Ozone[a]	N/A	Moderate Nonattainment
	8-hour Ozone	Unclassified/Attainment	Nonattainment-Transitional
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Contra Costa	1-hour Ozone[a]	N/A	Serious Nonattainment
	8-hour Ozone	Marginal Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
El Dorado	1-hour Ozone[a]	N/A	Nonattainment/Serious Nonattainment/Attainment (P)
	8-hour Ozone	Serious Nonattainment (P)	Nonattainment/ Unclassified (P)
	CO	Moderate Maintenance (P)	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment (P)	Unclassified/Attainment (P)
	NO_2	Unclassified/Attainment	Attainment
Fresno	1-hour Ozone[a]	N/A	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Glenn	1-hour Ozone[a]	N/A	Moderate Nonattainment
	8-hour Ozone	Unclassified/Attainment	Nonattainment-Transitional
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Kern	1-hour Ozone[a]	N/A	Severe Nonattainment/Moderate Nonattainment (P)
	8-hour Ozone	Former Subpart 1/ Serious Nonattainment (P)	Nonattainment
	CO	Unclassified/ Maintenance (P)	Attainment/Unclassified (P)

County	Pollutant	National	State
	PM10	Serious Nonattainment/ Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment (P)	Nonattainment/Unclassified (P)
	NO_2	Unclassified/Attainment	Attainment
Kings	1-hour Ozone[a]	N/A	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Lake	1-hour Ozone[a]	N/A	Attainment
	8-hour Ozone	Unclassified/Attainment	Attainment
	CO	Unclassified/Attainment	Attainment
	PM10	Unclassified/Attainment	Attainment
	PM2.5	Unclassified/Attainment	Attainment
	NO_2	Unclassified/Attainment	Attainment
Lassen	1-hour Ozone[a]	N/A	Attainment
	8-hour Ozone	Unclassified/Attainment	Unclassified
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Madera	1-hour Ozone[a]	N/A	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Mariposa	1-hour Ozone[a]	N/A	Nonattainment
	8-hour Ozone	Former Subpart 1	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Unclassified
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Merced	1-hour Ozone[a]	N/A	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Modoc	1-hour Ozone[a]	N/A	Attainment
	8-hour Ozone	Unclassified/Attainment	Unclassified
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified

County	Pollutant	National	State
	NO_2	Unclassified/Attainment	Attainment
Napa	1-hour Ozone[a]	N/A	Serious Nonattainment
	8-hour Ozone	Marginal Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Nevada	1-hour Ozone[a]	N/A	Nonattainment
	8-hour Ozone	Former Subpart 1(P)	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Placer	1-hour Ozone[a]	N/A	Nonattainment/ Attainment (P)
	8-hour Ozone	Serious Nonattainment (P)	Nonattainment/ Unclassified (P)
	CO	Unclassified/ Moderate Maintenance (P)	Unclassified/Attainment (P)
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment (P)	Unclassified/Attainment/ Nonattainment (P)
	NO_2	Unclassified/Attainment	Attainment
Plumas	1-hour Ozone[a]	N/A	Unclassified
	8-hour Ozone	Unclassified/Attainment	Unclassified
	CO	Unclassified/Attainment	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Sacramento	1-hour Ozone[a]	N/A	Serious Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Moderate Nonattainment	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
San Benito	1-hour Ozone[a]	N/A	Moderate Nonattainment
	8-hour Ozone	Unclassified/Attainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Attainment
	NO_2	Unclassified/Attainment	Attainment
San Joaquin	1-hour Ozone[a]	Extreme Nonattainment	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Shasta	1-hour Ozone[a]	N/A	Moderate Nonattainment

County	Pollutant	National	State
	8-hour Ozone	Unclassified/Attainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Sierra	1-hour Ozone[a]	N/A	Unclassified
	8-hour Ozone	Unclassified/Attainment	Unclassified
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Siskiyou	1-hour Ozone[a]	N/A	Attainment
	8-hour Ozone	Unclassified/Attainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Attainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Solano	1-hour Ozone[a]	N/A	Serious Nonattainment
	8-hour Ozone	Maringal Nonattainment (P)	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment (P)	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Stanislaus	1-hour Ozone[a]	N/A	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Sutter	1-hour Ozone[a]	N/A	Serious/Moderate Nonattainment (P)
	8-hour Ozone	Serious Nonattainment/ Former Subpart 1 (P)	Nonattainment
	CO	Unclassified/Attainment	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Tehama	1-hour Ozone[a]	N/A	Moderate Nonattainment
	8-hour Ozone	Unclassified/Attainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Tulare	1-hour Ozone[a]	N/A	Severe Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Unclassified/Attainment	Attainment

County	Pollutant	National	State
	PM10	Serious Maintenance (P)	Nonattainment
	PM2.5	Nonattainment	Nonattainment
	NO_2	Unclassified/Attainment	Attainment
Tuolumne	1-hour Ozone[a]	N/A	Nonattainment
	8-hour Ozone	Former Subpart 1	Nonattainment
	CO	Unclassified/Attainment	Attainment
	PM10	Unclassified/Attainment	Unclassified
	PM2.5	Unclassified/Attainment	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Yolo	1-hour Ozone[a]	N/A	Serious Nonattainment
	8-hour Ozone	Serious Nonattainment	Nonattainment
	CO	Moderate Maintenance (P)	Attainment
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment (P)	Unclassified
	NO_2	Unclassified/Attainment	Attainment
Yuba	1-hour Ozone[a]	N/A	Moderate Nonattainment
	8-hour Ozone	Unclassified/Attainment	Nonattainment
	CO	Unclassified/Attainment	Unclassified
	PM10	Unclassified/Attainment	Nonattainment
	PM2.5	Nonattainment (P)	Unclassified
	NO_2	Unclassified/Attainment	Attainment

Notes:
CO – carbon monoxide.
N/A = not available/applicable.
NO_2 = nitrogen dioxide.
PM2.5 = particulate matter 2.5 microns in diameter or less.
PM10 = particulate matter 10 microns in diameter or less.
(P) = Designation applies to a portion of the county.
[a] The U.S. Environmental Protection Agency (EPA) revoked the 1-hour ozone standard on June 15, 2005.
[b] On June 8, 2007, the United States Court of Appeals vacated the Subpart 1 portion of the Phase 1 Rule. The Subpart 1 areas in the Greenbook are listed as “Former Subpart 1” until reclassification of the areas is finalized. Proposed reclassifications were published on January 16, 2009 (74 FR 2936).
[c] EPA will redesignate the entire county as a nonattainment area on or before March 12, 2010.
Sources: ARB 2009b, EPA 2009b, Williams pers. comm.

Sensitive Land Uses

Air quality-sensitive land uses are generally defined as locations where sensitive receptors reside. Sensitive receptors are more susceptible to health problems associated with air pollutants. Some examples of sensitive receptors are schools, elderly housing, hospitals, and clinics. Land uses in the program area where sensitive receptors may be exposed to increased levels of pollutants during program construction include residences, schools, and parks that may be located near (within 1 mile) farms or other areas where construction activities associated with the program will occur. As farms are typically located in rural areas, the number of sensitive receptors affected by the program alternatives is expected to be minimal.

5.5.4 Impacts

Air quality impacts from the program alternatives would result from construction activities and program operation. This section describes the potential impacts related to these sources resulting from the five program alternatives. Mitigation measures to reduce significant impacts are also identified. Table 5.5-7 provides a summary of the potential impacts for each alternative relative to the baseline condition. For the purposes of this analysis, the baseline conditions were assumed to be the current regulatory program as instituted at the time of the writing of the ECR (refer to Chapter 3).

Table 5.5-7. Summary of Potential Impacts Relative to Baseline Conditions

Alternative	Construction Emission	Operational Emissions	Toxic Air Contaminants
Alternative 1	+	+	+ (diesel PM) - (pesticides)
Alternative 2	++	+/-	+ (diesel PM) - (fertilizers/pesticides)
Alternative 3	++	+/-	+ (diesel PM) - (fertilizers/pesticides)
Alternative 4	++	+/-	+ (diesel PM) - - (fertilizers/pesticides)
Alternative 5	+++	+/-	++ (diesel PM) - - (fertilizers/pesticides)

Notes: PM = particulate matter.
+ Increasing emissions relative to the baseline.
- Decreasing emissions relative to the baseline.
+/- Information inconclusive. Potential increase or decrease in emissions relative to baseline.

Assessment Methods

Construction Emissions

Construction emissions, including ozone precursors (ROG and NO_X), CO, PM10, and PM2.5, are primarily the result of earth-moving activities and heavy-duty diesel-powered equipment. Management practices used to prevent impacts on water quality that require physical changes or heavy-duty equipment would generate construction emissions. Table 5.5-8 summarizes the management practices expected under each alternative and describes their potential construction emissions. In addition to these management practices, installation of monitoring wells would require not only construction of the well itself but also any accessory facilities (e.g., pump houses and access roads).

Table 5.5-8. Summary of Management Practices and Potential Construction Emissions

Management Practice	Applicable Alternatives	Potential Construction Emissions
Nutrient management	Alternatives 1 through 4 where nutrient or dissolved oxygen problems are identified Alternative 5, all growers	N/A—no construction required under this management practice.[a]
Improved water management	Alternatives 1 through 5 where COCs are identified	N/A—no construction required under this management practice.[b]
Tailwater recovery system	Alternatives 1 through 5 where COCs are identified	Generation of exhaust emissions from construction equipment (e.g., backhoe, small bulldozer) required to dig and excavate the catchment pond and install pumps. Minor generation of fugitive dust from excavation activities.
Pressurized irrigation	Alternatives 1 through 5 where COCs are identified	If construction equipment is required to set up the irrigation system, minor amounts of exhaust emissions would be generated.
Sediment trap, hedgerow, or buffer	Alternatives 1 through 5 where COCs are identified	Generation of exhaust emissions from construction equipment required to create the trap or physical barrier.
Cover cropping or conservation tillage	Alternatives 1 through 5 where COCs are identified	N/A—no construction required under this management practice.[c]
Wellhead protection	Alternatives 2 through 5	Generation of exhaust emissions from construction equipment required to create the berm. Minor generation of fugitive dust from excavation activities.

Notes:

COCs = constituents of concern.

N/A = not applicable.

[a] This practice may result in reduced fertilizer and pesticide application, thereby reducing toxic air contaminants.

[b] This practice may reduce the amount of water currently being pumped, thereby reducing emissions associated with diesel exhaust.

[c] It is likely that this practice will reduce fugitive dust (PM10 and PM2.5) emissions by reducing the amount of soil exposed to the elements.

Pollutant emissions are highly dependent on the total amount of disturbed area, the duration of construction, and the intensity of construction activity. In addition, the number and types of heavy-duty equipment significantly affect the generation of diesel particulate matter (DPM). Construction impacts can thus vary depending on the management practices implemented under the program alternative. In general, however, construction required by the various management practices would be minor. Consequently, construction emissions resulting from program implementation most likely would be miniscule on a per-farm basis.

The selection of management practices is a function of crop type, physical setting, and economics. The origin of regulatory authority (e.g., coalition groups versus individual growers) may affect funding sources, outreach, and enforcement; but selection of management practices is ultimately dependent on economics, agronomic needs, and the environment (ICF Jones & Stokes 2008). It is therefore difficult to determine how changes in the lead entity as a result of the program alternatives would affect, if at all, management practices used to prevent water quality impacts. Consequently, a quantified analysis of potential construction emissions is not possible, and a qualitative assessment of air quality effects resulting from the proposed program alternatives was performed. The qualitative analysis took into account the following:

- Stipulations for installation of monitoring wells,
- Interrelationship between monitoring and implementation of management practices,
- Generation of fugitive dust from management practices requiring earthwork, and
- Generation of emissions from the use of heavy-duty diesel-powered equipment.

Operational Emissions

Long-term air quality impacts are associated with changes in the permanent, continued daily use of the program area. Operational emissions from the program alternatives would primarily result from vehicle trips for site inspections and monitoring. Implementation of tailwater recovery systems would require the use of pumps, likely diesel powered, that also would be considered a source of operational emissions. Likewise, if individual groundwater wells require diesel-powered pumps; these facilities would contribute to operational impacts. These sources are expected to be transitory and short term (e.g., semi-annual well sampling, back-up pump motors, and annual inspections), but the extent of these activities is unknown at this time.

Possible operational emissions resulting from the proposed program alternatives would include ozone precursors (ROG and NO_X), PM10, PM2.5, and pesticides/fertilizers. Emissions are dependent on the frequency of activity and the type of emission source. In addition, implementation of nutrient management plans and conservation tillage may result in air quality benefits by reducing the use of nutrients and fertilizers.

The level of potential operational activities and the number of sources that may result from implementation of program alternatives are currently unknown. Therefore, a quantified analysis of potential emissions is not possible, and a qualitative analysis of operational emissions was performed. The qualitative analysis took into account provisions for groundwater monitoring plans and wells, as well as the frequency and responsible party for site inspections.

Toxic Air Contaminants/Hazardous Air Pollutants

TACs and HAPs associated with the proposed program include pesticides, NOA, and DPM from operation of diesel-fueled construction equipment. Given the uncertainty in potential emission sources and the level of activity associated with the proposed program alternatives, a qualitative analysis of TAC/HAP emissions was performed. The qualitative analysis took into account the factors considered during the evaluation of construction and operational emissions (listed above).

Significance Determinations

For this analysis, an impact pertaining to air quality was considered significant under CEQA if it would result in any of the following environmental effects, which are based on professional practice and State CEQA Guidelines Appendix G (14 CCR 15000 et seq.):

- Conflict with or obstruct implementation of the applicable air quality plan,

- Violate any air quality standard or contribute substantially to an existing or projected air quality violation,
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is designated as nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors),
- Expose sensitive receptors to substantial pollutant concentrations, or
- Create objectionable odors affecting a substantial number of people.

In addition, the State CEQA Guidelines state that the significance criteria established by the applicable air quality management or air pollution control district may be relied on to make the determinations above. Significance criteria for each of the various air districts are summarized in Table 5.5-2. Impacts related to air quality were determined using the local thresholds identified in Table 5.5-2 based on the respective air district in which the program activity is located.

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Impact AQ-1. Generation of Construction Emissions in Excess of Local Air District Thresholds

Alternative 1 involves full implementation of the existing regulatory program. Coalition groups would function as the lead entities, and growers would implement management practices when surface water monitoring data show two or more exceedances of water quality objectives.

Construction impacts would result from implementation of management practices that require physical changes or the use of heavy-duty equipment (See Table 5.5-8). As stated above, it is difficult to determine how management practices selected under this alternative would change relative to existing conditions. It is therefore not possible to determine construction-related effects based on a quantitative analysis. However, it is logical to assume that, as monitoring continues under Alternative 1, it would result in selection and implementation of more management plans and resulting management practices. Consequently, implementation of Alternative 1 may result in increased criteria pollutant emissions from construction activities relative to baseline conditions.

Construction emissions associated with Alternative 1 would result in a significant impact if the incremental difference, or increase, relative to existing conditions exceeds the applicable air district thresholds shown in Table 5.5-2. Management practices with the greatest potential for emissions include those that break ground or move earth matter, thus producing fugitive dust, and those that require the use of heavy equipment (e.g., backhoes or bulldozers), thus producing criteria pollutants from exhaust. The management practices fitting this description are sediment trap, hedgerow, or buffer; pressurized irrigation; and tailwater recovery systems.

While it is anticipated that any emissions resulting from construction activities would be minuscule on a per-farm basis, in the absence of a quantitative analysis, data are insufficient to determine whether emissions would exceed threshold levels. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure AQ-MM-1** by growers would reduce this impact to a less-than-significant level.

Impact AQ-2. Generation of Operational Emissions in Excess of Local Air District Thresholds

Alternative 1 does not involve any groundwater monitoring or grower site inspections. Operational emissions therefore would result from vehicle trips made by the coalition groups to perform surface water quality monitoring and from diesel-powered wells installed in tailwater recovery systems.

Surface water quality monitoring is already occurring under existing conditions. Alternative 1 therefore is not expected to result in an appreciable difference in operational emissions related to vehicle trips for monitoring. However, installation of diesel-powered pumps as part of tailwater recovery systems would represent an additional source of emissions. With limited information on the number and hours of operation associated with these pumps, a quantitative analysis of emissions is not possible.

Any new emissions generated under Alternative 1 are not expected to be substantial or to exceed applicable air district thresholds. In addition, they may be moderated by emissions benefits related to management practices that reduce irrigation and cover crops (see Table 5.5-8). However, the difference in emissions relative to existing conditions is not known at this time and therefore cannot be compared to the significance criteria. This is considered a potentially significant impact. Implementation of **Mitigation Measure AQ-MM-2** would reduce this impact to a less-than-significant level.

Impact AQ-3. Elevated Health Risks from Exposure of Nearby Sensitive Receptors to TACs/HAPs

TACs and HAPs resulting from Alternative 1 include DPM from diesel construction equipment and new pumps, pesticides/fertilizers, and asbestos. Sensitive receptors near member growers could be affected by these sources.

As discussed in Chapter 3, one of the goals of the nutrient management and conservation tillage management practices is to reduce the application of pesticides/fertilizers. Because Alternative 1 would result in greater likelihood of these management practices being implemented, it is reasonable to assume that pesticides/fertilizers—and thus the potential for exposure to these chemicals—would be reduced under Alternative 1.

It is expected that construction emissions may increase relative to existing conditions, thus resulting in minor increases of DPM. Elevated levels of construction in areas where NOA is common may also increase the likelihood of exposure to asbestos. New diesel-powered pumps also would increase DPM emissions relative to baseline conditions. This is considered a potentially significant impact. Implementation of **Mitigation Measures AQ-MM-1**, **AQ-MM-2**, and **AQ-MM-3** would reduce this impact to a less-than-significant level.

Alternative 2 – Third-Party Lead Entity

Impact AQ-1. Generation of Construction Emissions in Excess of Local Air District Thresholds

As discussed previously, it is difficult to determine how changes in the lead entity as a result of the program alternatives would affect, if at all, management practices used to prevent water quality impacts. Impacts related to generation of construction emissions under Alternative 2 are expected to be similar to those described for Alternative 1 (see **Impact AQ-1**). However, because wellhead protection, which requires the use of heavy-duty equipment, may be implemented by some farmers as a management practice for fertilizer use (see Table 5.5-8), construction emissions may be slightly greater than those anticipated for Alternative 1. This is considered a potentially significant impact. Implementation of **Mitigation Measure AQ-MM-1** would reduce this impact to a less-than-significant level.

Impact AQ-2. Generation of Operational Emissions in Excess of Local Air District Thresholds

Under Alternative 2, operational emissions would result from vehicle trips made by the third-party groups to perform surface water and groundwater monitoring, and from new diesel-powered pumps installed as part of tailwater recovery systems. Existing wells that are already in operation would be used to conduct the regional groundwater monitoring. Consequently, it is not anticipated that new stationary sources would be operated as part of the groundwater monitoring plans.

This alternative allows for a reduction in surface water quality monitoring under low-threat circumstances or when watershed or area management objectives plans have been adopted. Consequently, the number of trips, and thus operational emissions, associated with surface water quality monitoring may be reduced relative to existing regulations. However, new vehicle trips for regional groundwater monitoring and operation of new diesel-powered pumps for tailwater recovery systems may outweigh any emissions benefits achieved by this reduction. With limited information on the number and distances of vehicle trips associated with monitoring, and the number and hours of operation of the pumps, a quantitative analysis of emissions is not possible.

Any new emissions generated under Alternative 2 are not expected to be substantial or to exceed applicable air district thresholds. In addition, they may be moderated by emissions benefits related to management practices that reduce irrigation and cover crops (see Table 5.5-8). However, the difference in emissions relative to existing conditions is not known at this time and therefore cannot be compared to the significance criteria. This is considered a potentially significant impact. Implementation of **Mitigation Measure AQ-MM-2** would reduce this impact to a less-than-significant level.

Impact AQ-3. Elevated Health Risks from Exposure of Nearby Sensitive Receptors to TACs/HAPs

Impacts related to elevated health risks from exposure to HAPs and TACs under Alternative 2 are expected to be similar to those described for Alternative 1. Please refer to **Impact AQ-1**. This is considered a potentially significant impact. Implementation of **Mitigation Measures AQ-MM-1**, **AQ-MM-2**, and **AQ-MM-3** would reduce this impact to a less-than-significant level.

Alternative 3 – Individual Farm Water Quality Management Plans

Impact AQ-1. Generation of Construction Emissions in Excess of Local Air District Thresholds

As discussed previously, it is difficult to determine how changes in the lead entity as a result of the program alternatives would affect, if at all, management practices used to prevent water quality impacts. Impacts related to generation of construction emissions under Alternative 3 are expected to be similar to those described for Alternative2. Please refer to **Impact AQ-1**. This is considered a potentially significant impact. Implementation of **Mitigation Measure AQ-MM-1** would reduce this impact to a less-than-significant level.

Impact AQ-2. Generation of Operational Emissions in Excess of Local Air District Thresholds

Operational emissions would result from vehicle trips made by the Central Valley Water Board or another implementation agency to conduct annual site inspections on 5 percent of farms and from new diesel-powered pumps installed as part of tailwater recovery systems. This alternative does not require growers or the Central Valley Water Board to perform surface water or groundwater monitoring. Rather, individual growers would conduct visual inspections of their own farms. Consequently, minimal emissions would be associated with vehicle travel. Because surface water quality monitoring, which generates emissions from vehicle trips, is required under existing conditions, implementation of Alternative 3 would reduce emissions from this activity relative to existing regulations.

Operational emissions from vehicle travel for grower site inspections are expected to be minimal. The number and distances of trips that would be completed as part of Alternative 3 are not currently known. Likewise, the number of new well pumps to be installed as part of tailwater recovery systems is unavailable. Consequently, it is not possible to quantify emissions or determine whether new emissions from site inspections and well pumps would offset the reduction benefits achieved by eliminating vehicle trips for water quality monitoring.

Operational emissions would result in a significant effect if the incremental difference, or increase, relative to existing conditions exceeds any of the applicable air district thresholds shown in Table 5.5-2. Any increase in emissions generated by Alternative 3 is expected to be miniscule and may be moderated by emissions benefits related to management practices that reduce irrigation and cover crops (see Table 5.5-8). However, the magnitude of potential emissions is not known at this time. This impact is considered potentially significant. Implementation of **Mitigation Measure AQ-MM-2** would reduce this impact to a less-than-significant level.

Impact AQ-3. Elevated Health Risks from Exposure of Nearby Sensitive Receptors to TACs/HAPs

Impacts related to elevated health risks from exposure to HAPs and TACs under Alternative 3 are expected to be similar to those described for Alternative 2. Please refer to **Impact AQ-3**. This is considered a potentially significant impact. Implementation of **Mitigation Measures AQ-MM-1**, **AQ-MM-2**, and **AQ-MM-3** would reduce this impact to a less-than-significant level.

Alternative 4 – Direct Oversight with Regional Monitoring

Impact AQ-1. Generation of Construction Emissions in Excess of Local Air District Thresholds

As discussed previously, it is difficult to quantify how changes in the lead entity as a result of the program alternatives would affect, if at all, the management practices used to prevent water quality impacts. Impacts associated with generation of construction emissions under Alternative 4 are expected to similar to those described for Alternatives 2 and 3. Please refer to **Impact AQ-1**. This impact is considered potentially significant. Implementation of **Mitigation Measure AQ-MM-1** would reduce this impact to a less-than-significant level.

Impact AQ-2. Generation of Operational Emissions in Excess of Local Air District Thresholds

Under Alternative 4, operational emissions would result from vehicle trips made by lead entities to perform water quality monitoring, vehicle trips made by the Central Valley Water Board to perform grower site inspections, and new diesel-powered pumps installed as part of tailwater recovery systems. Alternative 4 allows for individual growers to perform their own monitoring, depending on the threat level of their operation to water quality. Vehicle trips associated with this type of monitoring include those required to transport samples to the laboratory for analysis.

Emissions benefits may be achieved through practices that reduce irrigation and cover crops (see Table 5.5-8). However, in the absence of a quantitative analysis, data are insufficient to determine how the net operational emissions under Alternative 4 would change relative to existing regulations. Although any increases in emissions are expected to be minuscule and to not exceed air district thresholds, the magnitude of emissions is presently unknown. This is considered a potentially significant impact. Implementation of **Mitigation Measure AQ-MM-2** would reduce this impact to a less-than-significant level.

Impact AQ-3. Elevated Health Risks from Exposure of Nearby Sensitive Receptors to TACs/HAPs

TACs and HAPs resulting from Alternative 4 include DPM from diesel construction equipment and new pumps, pesticides/fertilizers, and asbestos. Sensitive receptors near member growers could be affected by these sources. Because the extent of construction and operational activities is not known at this time, a determination of effects based on a quantitative analysis is not possible. Construction emissions are expected to increase relative to existing conditions, thus resulting in minor increases of DPM. Likewise, new diesel-powered pumps would increase DPM emissions relative to baseline conditions. Elevated levels of construction in areas where NOA is common also may increase the likelihood of exposure to asbestos.

Alternative 4 may result in greater likelihood of conservation tillage and nutrient management being selected as management practices. While the benefits of nutrient management practices on the quantity of pesticide application are difficult to estimate, it is logical to assume that stipulations for such practices would reduce pesticide use. Consequently, implementation of Alternative 4 is expected to decrease the risk of exposure of nearby sensitive receptors to pesticides relative to existing conditions.

Because implementation of Alternative 4 is expected to increase the risk of exposure to DPM and asbestos, this impact is considered potentially significant. Implementation of **Mitigation Measures AQ-MM-1**, **AQ-MM-2**, and **AQ-MM-3** would reduce this impact to a less-than-significant level.

Alternative 5 – Direct Oversight with Farm Monitoring

Impact AQ-1. Generation of Construction Emissions in Excess of Local Air District Thresholds

Under Alternative 5, construction impacts would result from installation of individual farm groundwater monitoring wells and implementation of management practices that require physical changes or the use of heavy-duty equipment. Construction emissions resulting from implementation of management practices are expected to be similar to those described for Alternatives 2, 3, and 4 (please see **Impact AQ-1**). However, the construction of individual farm groundwater monitoring wells and accessory facilities (e.g., pump houses and access roads) would generate new construction emissions. Consequently, implementation of Alternative 5 would result in increased criteria pollutant emissions from construction activities.

Construction emissions associated with Alternative 5 would result in a significant effect if the incremental difference, or increase, relative to existing conditions exceeds any of the applicable air district thresholds shown in Table 5.5-2. Management practices with the potential for the greatest emissions include sediment trap, hedgerow, or buffer; pressurized irrigation; wellhead protection; and tailwater recovery systems. Construction of individual groundwater wells most likely would require small earth-moving equipment, such as drills or bobcats.

While it is anticipated that any emissions resulting from construction activities would be minuscule, in the absence of a quantitative analysis, data are insufficient to determine whether emissions would exceed threshold levels. Consequently, this is considered a potentially significant effect. Implementation of **Mitigation Measure AQ-MM-1** would reduce this impact to a less-than-significant level.

Impact AQ-2. Generation of Operational Emissions in Excess of Local Air District Thresholds

Under Alternative 5, operational emissions would result from vehicle trips made by growers to transport well samples to the laboratory and the Central Valley Water Board to perform grower site inspections, as well as new stationary sources associated with the groundwater wells (e.g., pumps powered by motors). Because watershed monitoring is required under existing regulations, implementation of Alternative 5 would reduce emissions from this activity relative to existing conditions. In addition, emissions benefits may be achieved by management practices that reduce irrigation and cover crops (see Table 5.5-8). However, in the absence of a quantitative analysis, data are insufficient to determine whether this reduction would offset the increase in emissions from vehicle trips for grower site inspections and/or new stationary sources from individual groundwater wells.

Operational emissions would have a significant effect if the incremental difference, or increase, relative to existing conditions exceeds any of the applicable air district thresholds shown in Table 5.5-2. Any operational emissions resulting from implementation of Alternative 5 are not expected to exceed air district thresholds, but the magnitude of these emissions is not known at this time. This impact is considered potentially significant. Implementation of **Mitigation Measure AQ-MM-2** would reduce this impact to a less-than-significant level.

Impact AQ-3. Elevated Health Risks from Exposure of Nearby Sensitive Receptors to Construction-Related TACs/HAPs

TACs and HAPs resulting from Alternative 5 include DPM from diesel construction equipment and asbestos. In addition, new diesel-powered pumps would produce DPM. Sensitive receptors near member growers could be affected by these sources. Because the extent of construction and operational activities is not known at this time, a determination of effects based on a quantitative analysis is not possible. Construction emissions are expected to increase relative to existing conditions, thus resulting in minor increases of DPM. Elevated levels of construction in areas where NOA is common also may increase the likelihood of exposure to asbestos.

Because implementation of Alternative 5 is expected to increase the risk of exposure to DPM and asbestos, this impact is considered potentially significant. Implementation of **Mitigation Measures AQ-MM-1**, **AQ-MM-2**, and **AQ-MM-3** would reduce this impact to a less-than-significant level. Note that these measures may not be necessary in many cases where applicable air district thresholds do not exist.

5.5.5 Mitigation and Improvement Measures

Mitigation Measure AQ-MM-1: Apply Applicable Air District Mitigation Measures to Reduce Construction Emissions below the District Thresholds

Growers will apply appropriate construction mitigation measures from the applicable air district to reduce construction emissions. These measures will be applied on a project-level basis and may be tailored in consultation with the appropriate air district, depending on the severity of anticipated construction emissions. Although not specifically cited in this document, references to individual air district documents that contain recommended mitigation measures are included in Chapter 8, References.

Mitigation Measure AQ-MM-2: Apply Applicable Air District Mitigation Measures to Reduce Operational Emissions below the District Thresholds

Growers will apply appropriate mitigation measures from the applicable air district to reduce operational emissions. These measures were suggested by the district or are documented in official rules and guidance reports; however, not all districts make recommendations for operational mitigation measures. Where applicable, measures will be applied on a project-level basis and may be tailored in consultation with the appropriate air district, depending on the severity of anticipated operational emissions.

Mitigation Measure AQ-MM-3: Apply Applicable Air District Mitigation Measures to Reduce TAC/HAP Emissions

Growers will apply appropriate TAC and HAP mitigation measures from the applicable air district to reduce public exposure to DPM, pesticides, and asbestos. These measures were suggested by the district or are documented in official rules and guidance reports; however, not all districts make recommendations for mitigation measures for TAC/HAP emissions. These measures will be applied on a project-level basis and may be tailored in consultation with the appropriate air district, depending on the severity of anticipated TAC/HAP emissions.

Section 5.6
Climate Change

5.6.1 Introduction

This section discusses potential impacts on climate change associated with program alternatives. Specifically, the section discusses federal, state, and local regulations related to greenhouse gases (GHGs) that would apply to the program. It summarizes relevant information on global climate change and presents an analysis of the statewide, national, and global GHG emissions inventories. Conventional air pollutants (e.g., ozone precursors [ROG and NO_X], CO, and particulate matter) are addressed in Section 5.5, Air Quality.

5.6.2 Regulatory Framework

Climate change has only recently been widely recognized as an imminent threat to the global climate, economy, and population. Thus, the climate change regulatory setting—nationally, statewide, and locally—is complex and evolving. The following section identifies key legislation, executive orders, and seminal court cases relevant to the environmental assessment of program GHG emissions.

Federal

Federal Climate Change Policies

In 2002, President George W. Bush set a national policy goal of reducing the GHG emission intensity (tons of GHG emissions per million dollars of gross domestic product) of the U.S. economy by 18 percent by 2012. No binding reductions were associated with the goal. Rather, EPA administers a variety of voluntary programs and partnerships with GHG emitters in which EPA collaborates with industries producing and utilizing synthetic gases to reduce emissions of these particularly potent GHGs.

On September 30, 2009, EPA proposed a new rule that would establish significance thresholds for six GHGs. The rule would define when CAA permits under the New Source Review (NSR) and Title V operation permit programs would be required for new and existing facilities. The proposed threshold is 25,000 tons of carbon dioxide equivalents (CO_2e) per year. Facilities exceeding this threshold would be required to obtain a permit that would demonstrate they are using best management practices (BMPs). EPA estimates that 14,000 large sources would need to obtain permits, the majority of which would be municipal solid waste landfills. EPA is currently evaluating the proposal and will issue final guidance once a ruling has been made (EPA 2009a).

Massachusetts et al. vs. Environmental Protection Agency et al.

In *Massachusetts et al. vs. Environmental Protection Agency et al.* (April 2, 2007), the U.S. Supreme Court ruled that EPA was authorized by the CAA to regulate carbon dioxide (CO_2) emissions from new motor vehicles. The Court did not mandate that EPA enact regulations to reduce GHG emissions, but found that EPA could avoid taking action only if EPA found that GHGs do not contribute to climate change or EPA offered a "reasonable explanation" for not determining that GHGs contribute to climate change.

EPA Finding of Endangerment

On December 7, 2009, the EPA Administrator found that current and projected concentrations of CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) threaten the public health and welfare of current and future generations. Additionally, the Administrator found that combined emissions of CO_2, CH_4, N_2O, and HFCs from motor vehicles contribute to atmospheric concentrations and thus to the threat of climate change. Although the endangerment finding in itself does not place requirements on industry, it is an important step in the process of EPA regulating GHGs.

EPA has prepared various documents in support of the endangerment finding, including a *Summary of the Science Supporting EPA's Finding that Greenhouse Gases Threaten Public Health and Welfare* (EPA 2009b). The summary notes that "[c]limate change is expected to worsen regional ozone pollution, with associated risks in respiratory infection, aggravation of asthma, and premature death. The impact on particulate matter remains less certain."

Update on Corporate Average Fuel Economy (CAFE) Standards

On May 19, 2009, President Obama announced the enactment of a 35.5-miles-per-gallon fuel economy standard for automobiles and light-duty trucks that will take effect in 2012. On June 30, 2009, EPA granted California's waiver of CAA preemption to enforce new GHG emission standards for new motor vehicles beginning with the 2009 model year. The new regulations add four new GHG pollutants (CO_2, CH_4, N_2O, and HFCs) to the existing regulations for criteria, criteria-precursor, and TACs (EPA 2009c).

State

A variety of legislation has been enacted in California that relates to climate change, much of which sets aggressive goals for GHG reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents pursuant to CEQA.

Assembly Bill 32 Chapter 488, Statutes of 2006

The California Global Warming Solutions Act of 2006, widely known as AB 32, requires ARB to develop and enforce regulations for reporting and verification of statewide GHG emissions. ARB is directed to set a GHG emissions limit, based on 1990 levels, to be achieved by 2020. The bill sets a timeline for adopting a scoping plan for achieving reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that statewide GHG emissions must be reduced to 1990 levels by the year 2020. California needs to reduce GHG emissions by approximately 29 percent below "business as usual" (based on compliance with requirements in effect under applicable federal and state law) of year 2020 GHG emissions to achieve this goal. The bill requires ARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions. To help guide implementation of AB 32, ARB adopted the AB 32 Scoping Plan in December 2008 (ARB 2009a).

California Air Resources Board AB 32 Scoping Plan

In December 2008, ARB met the AB 32 mandate for approving a Scoping Plan for reducing California GHG emissions to 1990 levels by 2020 (ARB 2008). The Scoping Plan and earlier ARB reports included quantification of California's 1990 GHG emission levels at anticipated 2020 GHG emission levels based on projections of economic and population growth that were estimated on a business-as-usual scenario of compliance with existing federal and state laws and continuation of existing economic trends and other activities. ARB then subtracted the 1990 target GHG emissions from the forecast 2020 emissions and identified a numeric reduction target for GHGs that needed to be achieved for California to comply with AB 32. ARB calculations require a reduction of 28.3 percent (often rounded up to 29 percent) of GHG emissions in relation to the otherwise forecast business-as-usual scenario to meet AB 32 goals.

The Scoping Plan includes a wide variety of measures to reduce GHG emissions from multiple sectors of the economy, including the agricultural industry. According to ARB, California's agricultural sector represented 6 percent of the State's GHG emissions budget in 2004 (ARB 2009a). During development of the Scoping Plan, potential GHG mitigation measures were identified to help reduce these emissions from agricultural operations. Specifically, the Scoping Plan highlights voluntary adoption of manure digester technology as the main strategy for reducing GHG emissions from the agricultural sector. In 2013, the degree of this investment will be analyzed to determine whether implementation of the technology should be made mandatory (ARB 2009a).

Executive Order S-03-05 (2005)

California Executive Order S-03-05 (June 1, 2005) mandates a reduction of GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050. Although the 2020 target is the core of AB 32, and has effectively been incorporated into AB 32, the 2050 target remains the goal of the Executive Order.

Executive Order S-01-07 Low Carbon Fuel Standards

Executive Order S-01-07 (January 18, 2007) requires a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by ARB. ARB identified the low carbon fuel standards (LCFS) as a Discrete Early Action item under AB 32. On April 23, 2009, ARB adopted regulations implementing the LCFS.

Assembly Bill 1493 (Pavley), Chapter 200, Statutes of 2002

AB 1493 requires ARB to adopt regulations by January 1, 2005, to reduce GHG emissions from noncommercial passenger vehicles and light-duty trucks of model year 2009 and thereafter. For this mandate to take effect, ARB was required to obtain a federal waiver from EPA that would allow California to deviate from the national car and light-duty truck standards set by EPA under the CAA. This waiver, generally referred to as the Pavley Waiver after the principal author of AB 1493, was initially requested in 2004; the federal government declined to regulate GHG under the CAA.

California and other states sued the federal government, in an attempt to compel EPA to regulate GHG under the CAA and take action on the waiver request, which was also being sought by several other states. In April 2007, the U.S. Supreme Court ruled in *Massachusetts et al. v. Environmental Protection Agency et al.* (discussed above) that EPA has authority to regulate GHG emissions as pollutants. Nevertheless, the Pavley Waiver request was formally denied by EPA in December 2007. In January 2008, the State Attorney General filed a new lawsuit against EPA for denying California's request for the Pavley Waiver to regulate and limit GHG emissions from these automobiles. On June 30, 2009, EPA granted California's waiver of CAA preemption to enforce new GHG emission standards for new motor vehicles beginning with the 2009 model year.

2010 CEQA Guidelines, Section 15064.4

As required by SB 97, the Office of Planning and Research (OPR) has prepared guidelines for the analysis of GHG effects in CEQA documents. The guidelines were incorporated into the 2010 revisions of the CEQA analysis handbook. They confirm the discretion of lead agencies to determine appropriate significance thresholds, but require the preparation of an EIR if "there is substantial evidence that the possible effects of a particular project are still cumulatively considerable not withstanding compliance with adopted regulations or requirements."

Senate Bill 375 (Steinberg), Statutes of 2008

SB 375 (Steinberg) provides for a new planning process that would coordinate land use planning and regional transportation plans and funding priorities in order to help California meet the GHG reduction goals established in AB 32. SB 375 requires regional transportation plans, developed by Metropolitan Planning Organizations (MPOs), to incorporate a "sustainable communities strategy" in their regional transportation plans that will achieve GHG emission reduction targets set by ARB. SB 375 also includes provisions for streamlined CEQA review for some infill projects, such as transit-oriented development. SB 375 will be implemented over the next several decades. The first round of GHG emissions targets for MPOs are expected to take effect in September 2010.

Research on GHG Emissions from Fertilizer

According to ARB, N_2O represented 2.8 percent of California's total GHG emissions in 2004. Of these emissions, approximately 50 percent originated from agricultural soils, with the majority resulting from the application of organic and synthetic fertilizers (ARB 2009b). To better understand and quantify emissions, ARB is currently conducting research on agricultural emissions of N_2O. Results may be used to improve fertilizer management practices and develop a California-specific baseline for N_2O emissions (ARB 2009b).

Local

As discussed in Section 5.5, 24 local air districts manage air quality within the program area (see Figure 5.5-1). Currently, the San Joaquin Valley Air Pollution Control District (SJVAPCD), South Coast Air Quality Management District (SCAQMD), and Bay Area Air Quality Management District (BAAQMD) have developed guidelines for the analysis of GHGs in CEQA documents. The Sacramento Metropolitan Air Quality Management District (SMAQMD) is in the process of updating its CEQA guidelines, but has yet to publish a draft document. The following discussion provides a summary of the GHG guidance provided by the SJVAPCD, SCAQMD, and BAAQMD. Note that only the SJVAPCD has adopted their guidance as regulation. Thresholds proposed by the BAAQMD and SMAQMD are still undergoing revisions and have not been adopted as final regulations.

San Joaquin Valley Air Pollution Control District

In December 2009, the SJVAPCD formally adopted the region's first GHG thresholds for determining significant impacts with regard to climate change in CEQA documents. The SJVAPCD's guidance is intended to streamline CEQA review by pre-quantifying emission reductions that would be achieved through the implementation of best performance standards (BPS). BPS are developed by the SJVAPCD and are based on current technologies, operating principles, and energy efficiency tactics. According to the December 2009 report, development projects failing to implement BPS or demonstrate a 29 percent reduction in GHG emissions relative to business-as-usual (BAU) conditions are considered to result in a significant impact on climate change (SJVAPCD 2009).

South Coast Air Quality Management District

On December 5, 2008, the SCAQMD Governing Board adopted the staff proposal for an interim GHG significance threshold for stationary/industrial projects where the SCAQMD is lead agency. The interim thresholds use a tiered approach, where Tier 3 is expected to be the primary tier by which the SCAQMD will determine significance. The Tier 3 screening level proposes a threshold of 10,000 metric tons of CO_2e per year for stationary/industrial sources, which represents a 90-percent emissions capture rate. Indirect, direct, and to the extent feasible, life cycle emissions from both construction (amortized over 30 years), and operational activities will be added and compared to the proposed threshold. At this time, the SCAQMD is reviewing a GHG significance threshold for residential/commercial projects (SCAQMD 2008).

Bay Area Air Quality Management District

The BAAQMD released its CEQA Air Quality Guidelines in December 2009 (EDAW 2009). The guidance proposes significance thresholds for operational GHG emissions. The BAAQMD currently does not recommend a construction GHG emission threshold because of insufficient information to determine an appropriate significance level. District staff recommends considering construction emissions on a case-by-case basis and encourages the implementation of BMPs.

The proposed threshold of significance for operational-related GHG emissions from land use projects is 1,100 metric tons of CO_2e per year. Projects exceeding this threshold would not be considered to result in a significant impact related to GHG emissions if their yearly GHG efficiency is less than 4.6 metric tons of CO_2e per service population (project jobs + projected residents) for mixed-use projects or if the project complies with an approved Climate Action Plan. The proposed threshold for stationary sources is 10,000 metric tons of CO_2e per year. If annual GHG emissions from project operations are below the above thresholds, the proposed project would result in a less-than-significant impact on global climate change (EDAW 2009).

5.6.3 Environmental Setting

Global Climate Change

Global climate change is caused in large part by anthropogenic (human-made) emissions of GHGs released into the atmosphere through combustion of fossil fuels and by other activities that affect the global GHG budget, such as deforestation and land use change. According to the California Energy Commission (CEC), GHG emissions in California are attributable to human activities associated with industrial/manufacturing, utilities, transportation, residential, and agricultural sectors as well as natural processes (CEC 2006).

GHGs play a critical role in the Earth's radiation budget by trapping infrared radiation emitted from the Earth's surface that could have otherwise escaped to space. Prominent GHGs contributing to this process include water vapor, CO_2, N_2O, CH_4, ozone, certain HFCs and PFCs, and SF_6. This phenomenon, known as the *greenhouse effect*, keeps the Earth's atmosphere near the surface warmer than it would otherwise be and allows for successful habitation by humans and other forms of life. Combustion of fossil fuels releases carbon that has been stored underground into the active carbon cycle, thus increasing concentrations of GHGs in the atmosphere. Emissions of GHGs in excess of natural ambient concentrations are thought to be responsible for enhancement of the greenhouse effect and to contribute to what is termed *global warming*, a trend of unnatural warming of the Earth's natural climate. Higher concentrations of these gases lead to more absorption of radiation and warm the lower atmosphere further, thereby increasing evaporation rates and temperatures near the surface.

Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as ozone precursors) and TACs, which are primarily pollutants of regional and local concern. Because GHG emissions have long atmospheric lifetimes, GHGs are effectively well mixed globally and are expected to persist in the atmosphere for time periods several orders of magnitude longer than criteria pollutants such as ozone. Given their long atmospheric lifetimes, GHG emission reduction strategies can be effectively undertaken on a global scale whereby the mitigation of local GHG emissions can be offset by distant GHG reduction activities.

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant for the understanding of climate change, its potential impacts, and options for adaptation and mitigation. The IPCC predicts substantial increases in global temperatures between 1.1 and 6.4° Celsius (depending on scenario) by 2100 (IPCC 2007a).

Climate change could potentially affect the natural environment in California, and the world at large, in the following ways:

- Rising sea levels along the California coastline, particularly in San Francisco and the Delta due to ocean expansion;
- Changing extreme-heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent;
- Increasing wildfire frequency and intensity;
- Increasing heat-related human deaths, infectious diseases, and risk of respiratory problems caused by deteriorating air quality;
- Decreasing snow pack and stream flow in the Sierra Nevada, affecting winter recreation and water supplies;
- Increasing severity of winter storms, affecting peak stream flows and flooding;
- Changing growing season conditions that could affect California agriculture, causing variations in crop quality and yield; and

- Changing distribution of plant and wildlife species due to changes in temperature, competition from colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

These changes in California's climate and ecosystems are occurring at a time when California's population is expected to increase from 34 to 59 million by 2040 (CEC 2005). As such, the number of people potentially affected by climate change as well as the amount of anthropogenic GHG emissions expected under a business-as-usual scenario is expected to increase.

As a consequence of worldwide GHG emissions altering the global climate, the program area may be subject to increased vulnerability to the following impacts:

- Reduced water supply to the program area,
- Increased risk of heat-related human deaths,
- Increased spread of infectious diseases, and
- Increased risk of respiratory problems associated with deteriorating air quality in the program area.

Greenhouse Gases

AB 32 documents six gases: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6. Note that water vapor, although the most abundant GHG, is not included in AB 32 because natural concentrations and fluctuations far outweigh anthropogenic influences. This section documents the characteristics and sources of CO_2, CH_4, and N_2O. While extremely potent, HFCs, PFCs, and SF_6 are human-made chemicals emitted mainly from air conditioners and refrigerants, manufacturing processes, and power distribution, respectively. Consequently, these gases are less relevant to the analysis of climate change impacts related to the proposed program.

To simplify reporting and analysis, GHG emissions are compared by their global warming potential (GWP) (IPCC 1996 and 2001). The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2e, which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). For example, a high GWP represents high infrared absorption and long atmospheric lifetime when compared to CO_2. One must also select a time horizon to convert GHG emissions to equivalent CO_2 emissions, in order to account for chemical reactivity and lifetime differences between various GHG species. The standard time horizon for climate change analysis is 100 years. Generally, GHG emissions are quantified in terms of metric tons of CO_2e emitted per year.

Table 5.6-1 lists the GWP of each GHG, its lifetime, and its abundance in the atmosphere in parts per trillion. Collectively, HFCs, PFCs, and SF_6 are referred to as high global warming potential gases (HGWPG). CO_2 is by far the largest component of worldwide CO_2e emissions, followed by CH_4, N_2O, and HGWPGs in order of decreasing contribution to CO_2e.

Table 5.6-1. Lifetimes and Global Warming Potentials of Several Significant Greenhouse Gases

Gas	Global Warming Potential (100 years)	Lifetime (years)	1998 Atmospheric Abundance (ppt)[a]
CO_2	1	50–200	365,000,000
CH_4	21	9–15	1,745
N_2O	310	120	314
HFC-23	11,700	264	14
HFC-134a	1,300	14.6	7.5
HFC-152a	140	1.5	0.5
CF_4	6,500	50,000	80
C_2F_6	9,200	10,000	3
SF_6	23,900	3,200	4.2

[a] 1 ppt is a mixing ratio unit indicating the concentration of a pollutant in parts per trillion by volume.
Sources: IPCC 1996, 2001 (pages 388–390).

Carbon Dioxide

CO_2 is the most important anthropogenic GHG and accounts for more than 75 percent of all anthropogenic GHG emissions. Its long atmospheric lifetime (on the order of decades to centuries) ensures that atmospheric concentrations of CO_2 will remain elevated for decades after mitigation efforts to reduce GHG concentrations are promulgated (IPCC 2007b).

Increasing concentrations of CO_2 in the atmosphere are primarily a result of emissions from the burning of fossil fuels, gas flaring, cement production, and land use changes. Three-quarters of anthropogenic CO_2 emissions are the result of fossil fuel burning (and, to a very small extent, cement production), and approximately one-quarter of CO_2 emissions are the result of land use change (IPCC 2007b).

Atmospheric concentrations of anthropogenic CO_2 emissions have increased, most notably since the industrial revolution. CO_2 concentration has increased from approximately 280 to 379 parts per million (ppm) over the last 250 years (Solomon et al. 2007). The IPCC estimates that the present atmospheric concentration of CO_2 has not been exceeded in the last 650,000 years and is likely to be the highest ambient concentration in the last 20 million years (IPCC 2007b, Solomon et al. 2007).

Methane

CH_4, the main component of natural gas, is the second largest contributor to anthropogenic GHG emissions and has a GWP of 21 (AEP 2007; IPCC 1996).

Anthropogenic emissions of CH_4 are the result of growing rice, raising cattle, combusting natural gas, and mining coal (NOAA 2005). Atmospheric CH_4has increased from a pre-industrial concentration of 715 to 1,775 parts per billion (ppb) in 2005 (IPCC 2007a). Although the cause is unclear, atmospheric concentrations of CH_4 have not risen as quickly as anticipated (NOAA 2005).

Nitrous Oxide

N_2O is a powerful GHG, with a GWP of 310 (IPCC 1996). Anthropogenic sources of N_2O include agricultural processes, nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. N_2O is also used in rocket engines and racecars and as an aerosol spray propellant. Agricultural processes that result in anthropogenic N_2O emissions are fertilizer use and microbial processes in soil and water (AEP 2007).

N_2O concentrations in the atmosphere have increased from pre-industrial levels of 270 to 319 ppb in 2005 (IPCC 2007a).

Greenhouse Gas Inventories

A GHG inventory is a quantification of all GHG emissions and sinks within a selected physical and/or economic boundary. GHG inventories can be performed on a large scale (e.g., for global and national entities) or on a small scale (e.g., for a particular building or person).

Many GHG emission and sink specifications are complicated to evaluate because natural processes may dominate the carbon cycle. Although some emission sources and processes are easily characterized and well understood, some components of the GHG budget (e.g., the balance of GHG sources and sinks) are not known with accuracy. Because protocols for quantifying GHG emissions from many sources are currently under development by international, national, state, and local agencies, ad hoc tools must be developed to quantify emissions from certain sources and sinks in the interim.

The following sections outline the global, national, and statewide GHG inventories to provide a context for the magnitude of program-related emissions. GHG emissions from the agricultural sector are highlighted.

IPCC 2004 Global Greenhouse Gas Inventory

The most recent global GHG inventory analyzed emissions in 2004 and was conducted by the IPCC. According to the IPCC, global anthropogenic GHG emissions were estimated at 49 gigatons of CO_2e ($GtCO_2e$) in 2004, which is 24 percent greater than 1990 emissions levels. CO_2 contributed to 76.7 percent of total emissions, CH_4 accounted for 14.3 percent, N_2O contributed to 7.9 percent, and fluorinated gases (HFCs, PFCs, and SF_6) contributed to the remaining 1.1 percent of global emissions (IPCC 2007c). Table 5.6-2 presents global GHG emissions by sector, as defined in the IPPC report. As Table 5.6-2 indicates, the agricultural sector represents 13.5 percent of total GHG emissions.

Table 5.6-2. Global Greenhouse Gas Emissions from the IPCC 2004 Inventory ($GtCO_2e$)

Sector	2004 CO_2e Emissions
Energy	12.69
Industry	9.50
Forestry	8.53
Agriculture	6.61
Transportation	6.41
Residential and commercial buildings	3.87
Waste and wastewater	1.37
Total emissions	49

Notes:
CO_2e = carbon dioxide equivalents.
$GtCO_2e$ = gigatons of CO_2e.
Source: Adapted from IPCC 2007c (page 5).

National 2007 Greenhouse Gas Inventory

EPA estimates that total U.S. GHG emissions in 2007 amounted to 7,150.1 million metric tons of CO_2e ($MMTCO_2e$), which is 17 percent greater than 1990 levels (EPA 2009d). CO_2 contributed to 85.4 percent of total emissions, CH_4 accounted for 8.2 percent, N_2O contributed to 4.4 percent, and fluorinated gases (HFCs, PFCs, and SF_6) contributed to the remaining 2.1 percent of national emissions. Table 5.6-3 summarizes the U.S. GHG emissions in 2007, based on CO_2 equivalents. The agricultural sector represents approximately 6 percent of total GHG emissions (EPA 2009d).

Table 5.6-3. U.S. Greenhouse Gas Emissions from the EPA 2007 Inventory ($MMTCO_2e$)

Sector	2007 CO_2e Emissions
Energy	6,170.3
Industrial processes	353.8
Solvent and other product use	4.4
Agriculture	413.1
Land use, land-use change, and forestry	42.9
Waste	165.6
Total emissions	7,150.1

Notes:
CO_2e = carbon dioxide equivalents.
$MMTCO_2e$ = million metric tons of CO_2e.
Source: EPA 2009d (page ES-11).

State 2006 Greenhouse Gas Inventory

ARB recently completed a GHG inventory of California's 2006 GHG emissions. Their report states that 1990 emissions amounted to 433.3 $MMTCO_2e$, while 2006 emissions levels rose to

483.9 $MMTCO_2e$ (ARB 2009c). CO_2 emissions accounted for 89 percent of the state's 2006 inventory, followed by CH_4 (5 percent), N_2O (3 percent), and other gases including HGWPGs (3 percent) (ARB 2009c). Table 5.6-4 summarizes statewide GHG emissions by sector, as defined in ARB report, and indicates that GHGs from the agricultural sector represent 6 percent of total emissions.

Table 5.6-4. State Greenhouse Gas Emissions from the 2006 ARB Inventory ($MMTCO_2e$)

Sector	2006 CO_2e Emissions
Transportation	188.721
Electricity generation	106.458
Industry	101.619
Agriculture and forestry	29.034
Residential	29.034
Commercial	14.517
Other	14.517
Total emissions	483.9

Notes:
CO_2e = carbon dioxide equivalents.
$MMTCO_2e$ = million metric tons of CO_2e.
Emissions inventory includes estimates for carbon dioxide, methane, nitrous oxides, sulfur hexafluoride, hydroflourocarbons, and perfluorocarbons.
Source: Adapted from ARB 2009c.

5.6.4 Impacts

The primary GHG emissions generated from the program alternatives include CO_2, CH_4, and N_2O. Climate change impacts from the program alternatives would result from these GHGs emitted as vehicle exhaust during construction activities and program operation. In addition, as discussed above, application of fertilizers releases a significant amount of N_2O, which is a powerful GHG. This section describes the potential impacts resulting from these sources related to the five program alternatives. Mitigation measures to reduce significant impacts also are identified.

For the purposes of this analysis, the baseline conditions were assumed to be the current regulatory program as instituted at the time of the writing of the ECR (refer to Chapter 3).

Assessment Methods

GHG emissions (CO_2, CH_4, and N_2O) from construction activities are primarily the result of fuel use by construction equipment, as well as worker and vendor trips to the project site. Management practices used to prevent impacts on water quality that require heavy-duty equipment would generate GHG emissions through equipment exhaust (see Table 5.5-8). As described in Section 5.5, construction activity, and thus the number and type of heavy-duty equipment, can vary depending on the management practices implemented under the proposed program. In general, however, construction required by the various management practices would be minor. Consequently, GHG emissions resulting from heavy-duty vehicle exhaust most likely would be miniscule.

Operational GHG emissions from the program alternatives would primarily result from vehicle trips for site inspections and monitoring. Diesel-powered well pumps for groundwater wells and tailwater recovery systems also may generate a minor amount of GHGs as exhaust. As discussed in Section 5.5, the extent of these activities is unknown at this time. However, GHG emissions from these sources are expected to be transitory and short term (e.g., semi-annual well sampling, back-up pump motors, and annual inspections).

Certain management practices also may result in GHG emissions benefits relative to existing conditions. For example, improved irrigation management may reduce the amount of time that pressurized pump generators are used. This practice also will help create water-efficient irrigation systems and devices, thereby reducing the amount of water required. Enhanced nutrient application may minimize the number of tractors required to plow a field. This practice also may reduce fertilizer use, which is a source of N_20 emissions. However, as discussed above, the extent and intensity of these activities are unknown.

The amount of GHG emissions from construction equipment and vehicle trips is heavily dependent on the type of management practice and the frequency of monitoring and site inspections, respectively. The number of diesel-powered well pumps also impact the quantity of GHGs emitted during program operation. Likewise, GHG reductions from improvements in irrigation and nutrient management are dependent on the number of farmers implementing these strategies, as well as the condition of their existing facilities. Because information on these sources is currently unavailable, a quantified analysis of potential GHG emissions is not possible (please refer to Section 5.5 for an expanded discussion on the availability of existing data). Consequently, a qualitative analysis of GHG emissions was performed. The qualitative analysis took into account the following:

- Stipulations for the installation of monitoring wells,
- Combustion emissions from heavy-duty equipment required by potential management practices,
- Provisions for groundwater monitoring plans and site inspections, and
- Stipulations for nutrient monitoring plans.

Significance Determinations

Certain criteria must be examined to determine whether a project will result in a significant effect on the environment. As of the writing of this report, the agencies with jurisdiction over air quality regulation and GHG emissions, such as EPA, ARB, and the various local air districts, have not formally adopted applicable significance thresholds, standards, or analysis protocols for the assessment of GHG emissions (please refer to Section 5.6.2). Thus, a methodology to establish an appropriate baseline or develop a program-level inventory for the proposed program, which would allow for an appropriate analysis of the program’s impacts on climate change or the impact of climate change on the proposed program, has not yet been established. Recent policy documents and proposed thresholds developed at federal, state, and local levels recommend that GHGs be addressed quantitatively based on their cumulative contribution to climate change impacts, rather than on a project-specific basis.

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Impact CC-1. Generation of Greenhouse Gas Emissions Resulting in Global Climate Change

Alternative 1 involves full implementation of the existing regulatory program. Coalition groups would function as the lead entities, and growers would implement management practices when surface water monitoring data show two or more exceedances of water quality objectives.

Implementation of Alternative 1 would result in local GHG emissions from construction equipment exhaust, diesel-powered well pumps installed as part of tailwater recovery systems, and vehicle trips for surface water quality monitoring. It is logical to assume that, as monitoring continues under Alternative 1, it would result in selection and implementation of more management plans and resulting management practices. Depending on the type of management practice selected, operational GHG emissions may be reduced relative to existing conditions due to improved irrigation systems and nutrient management. However, in the absence of project-specific information, it is difficult to determine which management practices would be selected or the number, type, and frequency of heavy-duty equipment that would be used.

As previously noted, GHG contaminants tend to accumulate in the atmosphere because of their relatively long lifespan. Consequently, their impact on the atmosphere is mostly independent of the point of emission. In other words, GHG emissions are more appropriately evaluated on a regional, state, or even national scale than on an individual level. Further, given the magnitude of state, federal, and national GHG emissions (see Section 5.6.3), it is unlikely that the minor amounts of GHG emissions resulting from vehicle and equipment exhaust would result in a discernible effect on global climate change. Consequently, this impact is considered less than significant at the local level. No mitigation is required.

Alternative 2 – Third-Party Lead Entity

Impact CC-1. Generation of Greenhouse Gas Emissions Resulting in Global Climate Change

Construction-related GHGs emitted under Alternative 2 are expected to be similar to those described for Alternative 1 (see **Impact CC-1**). Because the number of trips associated with surface water quality monitoring under Alternative 2 may be reduced relative to existing regulations, this alternative may reduce operational-related GHG emissions from vehicles. In addition, management practices that reduce well pumping and improve the efficiency of nutrient application may result in emissions benefits. However, new vehicle trips for regional groundwater monitoring, as well as the operation of new diesel-powered pumps for tailwater recovery systems, may outweigh any emissions benefits achieved by these reductions. With limited information on the number and distances of vehicle trips associated with monitoring, the number and hours of operation of the pumps, and the practices to be implemented, a quantitative analysis of emissions is not possible.

However, as discussed above, it is unlikely that the minor amounts of GHG emissions generated under Alternative 2 would result in a discernible effect on global climate change. Consequently, this impact is considered less than significant at the local level. No mitigation is required.

Alternative 3 – Individual Farm Water Quality Management Plans

Impact CC-1. Generation of Greenhouse Gas Emissions Resulting in Global Climate Change

Construction-related GHG emissions generated under Alternative 3 are expected to be similar to those described for Alternative 1 (see **Impact CC-1**).

As discussed in Section 5.6.4, Alternative 3 does not require growers or the Central Valley Water Board to perform surface water or groundwater monitoring. Consequently, no GHG emissions would be associated with this activity. However, GHG emissions would be generated by vehicle travel for grower site inspections and any new well pumps installed as part of tailwater recovery systems. Although these emissions are expected to be minimal, without a quantified analysis, it is not possible to determine whether new emissions from site inspections would offset the reduction benefits achieved by management strategies that reduce water consumption and enhance nutrient application. However, it is unlikely that any new GHG emissions resulting from vehicle exhaust would result in a discernible effect on global climate change. Consequently, this impact is considered less than significant at the local level. No mitigation is required.

Alternative 4 – Direct Oversight with Regional Monitoring

Impact CC-1. Generation of Greenhouse Gas Emissions Resulting in Global Climate Change

Implementation of Alternative 4 would result in local GHG emissions from construction equipment exhaust and would be similar to those anticipated under Alternative 1 (see **Impact CC-1**).

Operational GHGs from vehicle trips for sampling transport, site inspections, and regional water quality monitoring—as well as from any new well pumps installed as part of tailwater recovery systems—are expected under Alternative 4. However, implementation of nutrient management plans, which optimize the use of fertilizer, may reduce N_2O emissions. Likewise, other management practices that reduce water consumption and enhance nutrient application may result in emissions benefits. In the absence of a quantitative analysis, determining the net change in GHG emissions under this alternative is beyond the scope of this analysis. However, if GHG emissions were to increase relative to existing conditions, it is unlikely they would result in a discernible effect on global climate change due to the nature of GHGs. Consequently, this impact is considered less than significant at the local level. No mitigation is required.

Alternative 5 – Direct Oversight with Farm Monitoring

Impact CC-1. Generation of Greenhouse Gas Emissions Resulting in Global Climate Change

Implementation of Alternative 5 would result in GHG emissions from installation of individual farm groundwater wells and implementation of management practices that require the use of heavy-duty equipment. Construction emissions resulting from implementation of management practices are expected to be similar to Alternative 1 (see **Impact CC-1**). However, the construction of individual farm groundwater wells and accessory facilities (e.g., pump houses and access roads) would generate new GHG emissions. Consequently, construction-related GHG emissions under Alternative 5 may be slighter greater than those anticipated for Alternative 1.

Local GHG emissions also would be generated by vehicle trips for sampling transport and site inspections, as well as minor amounts of GHGs emitted by new compression engines required to power well pumps. Alternative 5 would result in N_2O reductions, as all farms would be required to develop a nutrient management plan. In the absence of a quantitative analysis, determining the net change in GHG emissions under this alternative is beyond the scope of this analysis. However, if GHG emissions were to increase, it is unlikely they would result in a discernible effect on global climate change due to the nature of GHGs. Consequently, this impact is considered less than significant at the local level. No mitigation is required.

5.6.5 Mitigation and Improvement Measures

Because the program alternatives would not result in any significant impacts on climate, no mitigation measures are required. However, given the seriousness of global climate change, any and all actions that reduce GHG emissions should be considered by program applicants. Potential actions include measures to reduce vehicle trips (e.g., optimizing route plans), use of alternative fuels, and using clean diesel and/or filters for construction equipment.

Mitigation Measure CC-MM-1: Apply Applicable Air District Mitigation Measures to Reduce Construction and Operational GHG Emissions (recommended)

Several of the standard mitigation measures provided by the 24 local air districts to reduce criteria pollutant emissions would also help to minimize GHG emissions (please see Section 5.6.5). Measures to reduce vehicle trips and promote use of alternative fuels, as well as clean diesel technology and construction equipment retrofits, should be considered by the program applicants.

Mitigation Measure CC-MM-2: Apply Applicable California Attorney General Mitigation Measures to Reduce Construction and Operational GHG Emissions (recommended)

A recent report by the California Attorney General's office entitled *The California Environmental Quality Act: Addressing Global Warming at the Local Agency Level* identifies various example measures to reduce GHG emissions at the project level (State of California Department of Justice 2008). The following mitigation measures and project design features were compiled from the California Attorney General's Office report. They are not meant to be exhaustive but to provide a sample list of measures that could be incorporated into future project design. Only those measures applicable to the proposed program are included.

Solid Waste Measures

- Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).
- Provide interior and exterior storage areas for recyclables and green waste and adequate recycling containers.
- Recover by-product methane to generate electricity.

Transportation and Motor Vehicles

- Limit idling time for commercial vehicles, including delivery and construction vehicles.
- Use low- or zero-emission vehicles, including construction vehicles.

Section 5.7
Vegetation and Wildlife

5.7.1 Introduction

This section describes potential impacts on vegetation and wildlife associated with the program alternatives. Specifically, it summarizes relevant laws and policies, discusses the existing environmental setting for vegetation and wildlife in the program area, and identifies potential impacts on vegetation and wildlife that may result from implementation of program alternatives. Mitigation measures to avoid or reduce potentially significant impacts also are presented.

The program area crosses a range of physiographic regions from the surrounding mountain ranges into the valleys. Each of these regions can be further subdivided into many habitats defined by the plant communities present and their associated wildlife species. Natural habitat types include valley riparian, conifer forests, oak woodland, chaparral, annual grassland, wetlands, and riverine; and human-influenced habitats include agricultural land, pastureland, managed wetland, and urban areas.

The varied habitat types within California are conducive to a great diversity of plant, animal, and fish species, many of which are endemic to the state. Because of habitat conversion to agriculture and residential and commercial development, many of these species have become rare, threatened, or endangered. Such species have been state or federally listed, or are candidate or proposed species for listing as protected under the California Endangered Species Act (CESA) and the ESA.

5.7.2 Regulatory Framework

The following federal, state, and local policies and laws are relevant to vegetation and wildlife in the program area.

Federal

Endangered Species Act

The ESA protects fish and wildlife species, and their habitats identified by USFWS and NMFS as threatened or endangered. Refer to Section 5.8, Fisheries, for additional explanation of the ESA.

Section 7 – Endangered Species Act Consultation Process

Section 7 ESA consultation provides a means for authorizing take of listed species for actions by federal agencies. Federal agency actions include activities that are:

- On federal land,
- Conducted by a federal agency,
- Funded by a federal agency, or
- Authorized by a federal agency (including issuance of federal permits and licenses).

Under Section 7, the federal agency conducting, funding, or permitting an action (the federal lead agency) must, in consultation with USFWS or NMFS as appropriate, ensure that its proposed action will not jeopardize the continued existence of an endangered or threatened species, or destroy or adversely modify designated critical habitat. If a proposed project "may affect" a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment (BA) evaluating the nature and severity of the expected effect. The BA is prepared for the proposed action and is submitted to USFWS or NMFS to initiate consultation. In response to a BA, USFWS or NMFS issues a biological opinion (BO), with a determination that the proposed action either:

- May jeopardize the continued existence of one or more listed species (jeopardy finding) or result in the destruction or adverse modification of critical habitat (adverse modification finding), or
- Will not jeopardize the continued existence of any listed species (no jeopardy finding) or result in adverse modification of critical habitat (no adverse modification finding).

The BO issued by USFWS or NMFS may stipulate discretionary "reasonable and prudent" conservation measures. If the proposed action would not jeopardize a listed species, USFWS or NMFS may issue an incidental take statement to authorize the proposed activity and may include appropriate measures to offset the impacts of take.

Section 9 – Endangered Species Act Prohibitions

Section 9 of the ESA prohibits the take of any fish or wildlife species listed under the ESA as endangered. Take of threatened species is also prohibited under Section 9, unless otherwise authorized by federal regulations. *Take*, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (Section 3 of the ESA; 16 United States Code [USC] Section 1532[19]). *Harm* is defined by regulation as "any act that kills or injures the species, including significant habitat modification" (50 CFR 17.3 222.102). In addition, Section 9 prohibits removing, digging up, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction. Section 9 does not prohibit take of federally listed plants on sites not under federal jurisdiction. If the project may result in take prohibited by Section 9, this take would need to be authorized through ESA Sections 7 or 10 (providing for the issuance of "incidental take" permits).

Sections 4(d) and 10 – Incidental Take

Incidental take of a listed species may be broadly authorized under Section 4(d) of the ESA, which authorizes incidental take consistent with certain conditions. Through a Section 4(d) rule, USFWS or NMFS may apply take prohibitions for threatened species but exempt certain programs or activities if they meet the requirements specified in the rule. NMFS may apply a Section 4(d) rule either at the time of listing or subsequently. A good example is the 4(d) rule that protects anglers if they accidentally catch a protected listed fish species, provided that they release it unharmed.

In cases where a nonfederal entity is undertaking an action that does not require federal authorization, the take of listed species must be permitted by USFWS or NMFS through Section 10 of the ESA. If the proposed action would result in the incidental take of a listed species, the applicant must first obtain a Section 10(a)(1)(B) incidental take permit (ITP). *Incidental take* under Section 10 is defined as take of federally listed fish and wildlife species "that is incidental to, but not the purposes of, otherwise lawful activities." To receive an ITP, the nonfederal entity is required to prepare a habitat conservation plan (HCP). The HCP must include conservation measures that avoid, minimize, and mitigate the project's impacts on listed species and their habitat.

Section 4(f) – Recovery Plans

Section 4(f) of the ESA requires that recovery plans be prepared for listed species. Recovery is the improvement of the status of the listed species to the point at which listing is no longer required. Recovery plans are guidance documents, not regulatory documents (NMFS 2009, http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Index.cfm). Recovery plans are intended to inform the recovery process for each species and for implementing the ESA as a whole (for example by providing a framework for Section 7 consultations, development of an HCP under Section 10, formulation of special rules under Section 4[d], and designation of critical habitat).

Clean Water Act

The CWA is the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. The CWA empowers the EPA to set national water quality standards and effluent limitations, and includes programs addressing both point-source and nonpoint-source pollution. *Point-source pollution* originates or enters surface waters at a single, discrete location, such as an outfall structure or an excavation or construction site. *Nonpoint-source pollution* originates over a broader area and includes urban contaminants in storm water runoff and sediment loading from upstream areas. The CWA operates on the principle that all discharges into the nation's waters are unlawful unless they are specifically authorized by a permit; permit review is the CWA's primary regulatory tool.

Section 404 – Permits for Discharges of Fill in Waters and Wetlands

CWA Section 404 regulates the discharge of dredged and fill materials into waters of the United States. *Waters of the United States* refers to oceans, bays, rivers, streams, lakes, ponds, and wetlands, including any of the features listed below.

- Areas within the ordinary high water mark (OHWM) of a stream, including non-perennial streams with a defined bed and bank and any stream channel that conveys natural runoff, even if it has been realigned.
- Seasonal and perennial wetlands, including coastal wetlands.

On January 9, 2001, the U.S. Supreme Court made a decision in *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers* (121 S. Ct. 675 [2001]), generally referred to as *SWANCC*, that affected U.S. Army Corps of Engineers (USACE) jurisdiction in isolated waters. Based on SWANCC, USACE no longer has jurisdiction or regulates isolated wetlands (i.e., wetlands with no hydrologic connection to waters of the United States).

Applicants must obtain a permit from USACE for all discharges of dredged or fill material into waters of the United States, including adjacent wetlands, before proceeding with a proposed activity. USACE may issue an individual permit evaluated on a case-by-case basis or a general permit evaluated at a program level for a series of related activities. General permits are preauthorized and are issued to cover multiple instances of similar activities expected to cause only minimal adverse environmental effects. Nationwide permits (NWPs) are a type of general permit issued to cover particular fill activities. Each NWP specifies particular conditions that must be met for the NWP to apply to a particular project, including acreage limits on the extent of fill.

Compliance with Section 404 requires compliance with several other environmental laws and regulations. USACE cannot issue an individual permit or verify the use of a general permit until the requirements of the National Environmental Policy Act (NEPA), ESA, and the NHPA have been met. In addition, USACE cannot issue or verify any permit until a water quality certification has been issued pursuant to CWA Section 401.

Section 401 – Water Quality Certification

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects with a federal component that may affect state water quality, including projects that require federal agency approval, such as issuance of a Section 404 permit, must also comply with Section 401.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC 703) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and the Soviet Union; the act authorizes the U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. It establishes seasons and bag limits for hunted species and protects migratory birds, their occupied nests, and their eggs (16 USC 703; 50 CFR 21, 10). Most actions that result in taking of or permanent or temporary possession of a protected species constitute violations of the MBTA. The MBTA also prohibits destruction of occupied nests. The Migratory Bird Permit Memorandum (MBPM-2) dated April 15, 2003, clarifies that destruction of most unoccupied bird nests is permissible under the MBTA; exceptions include nests of federally threatened or endangered migratory birds, bald eagles, and golden eagles. USFWS is responsible for overseeing compliance with the MBTA. Most bird species and their occupied nests that occur in the program area would be protected under the MBTA.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act makes it illegal to import, export, take (which includes molest or disturb), sell, purchase, or barter any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*), or parts thereof. The USFWS oversees enforcement of this act. The 1978 amendment authorizes the U.S. Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations.

State

California Endangered Species Act

The CESA (California Fish and Game Code [CFGC] Sections 2050–2068) generally parallels the main provisions of the ESA (16 USC 1531–1544) and is administered by the California Department of Fish and Game (DFG). A state lead agency is required to consult with DFG to ensure that any action it undertakes is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of essential habitat.

The CESA prohibits taking of listed species except as otherwise provided in state law. Unlike the ESA, the CESA applies the take prohibitions to species under petition for listing (state candidates) in addition to listed species.

Section 2081 of the CFGC expressly allows DFG to authorize the incidental take of endangered, threatened, and candidate species if all of the following conditions are met:

- The take is incidental to an otherwise lawful activity,
- The impacts of the authorized take are minimized and fully mitigated,
- Issuance of the permit will not jeopardize the continued existence of the species,
- The permit is consistent with any regulations adopted in accordance with Sections 2112 and 2114 (legislature-funded recovery strategy pilot programs in the affected area), and
- The applicant ensures that adequate funding is provided for implementing mitigation measures and monitoring compliance with these measures and their effectiveness.

The CESA provides that an incidental take permit obtained under the ESA may authorize the taking of the same species if it is listed under the CESA, with no further CESA authorization or approval required (CFGC Section 2080.1).

Regarding rare plant species, CESA defers to the California Native Plant Protection Act (CNPPA), which prohibits importing rare and endangered plants into California, taking rare and endangered plants, and selling rare and endangered plants. State-listed plants are protected mainly in cases where state agencies are involved in projects subject to CEQA. In these cases, plants listed as rare under the CNPPA are not protected under the CESA but can be protected under CEQA.

California Environmental Quality Act

CEQA is the regulatory framework by which California public agencies identify and mitigate significant environmental impacts. Although threatened and endangered species are protected by specific federal and state laws, the State CEQA Guidelines Section 15380(b) provides that a species not listed under the ESA or the CESA may be considered rare or endangered if it can be shown that the species meets certain specific criteria. The criteria have been modeled after the definitions of the ESA and sections of the CFGC discussing rare and endangered plants and animals.

A project normally is considered to result in a significant environmental effect (in the context of biological resources) if it *substantially* adversely affects a threatened, endangered, or rare species or *substantially* adversely affects the habitat of such species; *substantially* adversely affects wetlands under jurisdiction of Section 404 of the CWA; *substantially* interferes with the movement of native resident or migratory fish or wildlife; conflicts with any local policies or ordinances protecting biological resources, such as a tree preservation policy; or conflicts with the provisions of an adopted HCP, Natural Community Conservation Plan, or other approved local, regional, or state HCP. Substantial evidence includes fact, a reasonable assumption predicated on fact, or expert opinion supported by fact. The State CEQA Guidelines define rare, threatened, or endangered species as those listed under the ESA and the CESA, as well as any other species that meets the criteria of the resource agencies or local agencies—for example, DFG-designated species of special concern and plant species identified by the California Native Plant Society (CNPS) as being of conservation interest. The State CEQA Guidelines specify that the lead agency (in this case, the Central Valley Water Board) preparing a CEQA compliance document must consult with and receive written findings from USFWS and DFG concerning project impacts on species that are listed as endangered or threatened. The effects of the project on these species and habitats will be important in determining whether the project is considered to cause significant environmental impacts under CEQA. Although DFG does not specifically regulate the discharge or placement of material into wetlands (or waters of the state), impacts on these sensitive habitats also could be considered significant under CEQA—depending on the magnitude of impact.

California Fish and Game Code

Section 1602 – Streambed Alteration Agreements

Under CFGC Section 1602, public agencies are required to notify DFG before undertaking any project that would divert, obstruct, or change the natural flow, bed, channel, or bank of any river, stream, or lake. Regulation also generally includes riparian habitat adjacent to these water features. Preliminary notification and project review generally occur during the environmental process. When an existing fish or wildlife resource may be substantially adversely affected, DFG is required to propose reasonable project changes to protect the resources. These modifications are formalized in a streambed alteration agreement (SAA) that becomes part of the plans, specifications, and bid documents for the project.

Sections 3503 and 3503.5 – Occupied Bird Nests

Section 3503 of the CFGC prohibits killing birds and destruction of occupied bird nests. Sections 3503.5 and 3515 prohibit killing raptor and passerine species and destruction of occupied raptor and passerine nests. Consultation with DFG will be required if nesting birds will be affected by project-related activities.

Fully Protected Species

The CFCG prohibits take of *fully protected species*. Section 5050 lists fully protected amphibians and reptiles, Section 3511 lists fully protected birds, and Section 4700 lists fully protected mammals. The CFCG defines *take* as “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” Except for take related to scientific research, all take of fully protected species is prohibited. DFG cannot issue take permits for fully protected species.

Section 3513 – Migratory Birds

Section 3513 of the CFGC prohibits the take or possession of any migratory non-game bird as designated in the MBTA, or any part of such migratory non-game bird, except as provided by rules and regulations adopted by the U.S. Secretary of the Interior under provisions of the MBTA.

Regulatory Classification of Special-Status Species

Special-status species are plants and animals that are legally protected under state and federal Endangered Species Acts or other regulations, and species that are considered sufficiently rare by the scientific community to qualify for such listing. Special-status plants and animals are species in the following categories:

- Species listed or proposed for listing as threatened or endangered under the ESA (50 CFR 17.12 [listed plants], 50 CFR 17.11 [listed animals], and various notices in the Federal Register [FR] [proposed species]);
- Species that are candidates for possible future listing as threatened or endangered under the ESA (73 FR 75176, December 10, 2008; 71 FR 53755, September 12, 2006; 69 FR 24876, May 4, 2004);
- Species listed or proposed for listing by the State of California as threatened or endangered under the CESA (14 CCR 670.5);
- Species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- Plants listed as rare under the CNPPA (CFCG Sections 1900 et seq.);
- Plants considered by the CNPS to be "rare, threatened, or endangered in California" (Lists 1B and 2 in CNPS 2009);
- Plants listed by the CNPS as plants about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4 in CNPS 2009), which may be included as special-status species on the basis of local significance or recent biological information;
- Animal species of special concern to DFG (Remsen 1978 [birds], Williams 1986 [mammals], and Jennings and Hayes 1994 [amphibians and reptiles]); and
- Animals fully protected in California (CFGC Sections 3511 [birds], 4700 [mammals], and 5050 [amphibians and reptiles]).

Special-status species included in the analysis of impacts were limited to those listed under the ESA or the CESA and other species that DFG has designated as species of special concern. Inclusion in the impact analysis was based on overlapping of the species ranges with the program area, based on records from the California Natural Diversity Database (CNDDB) (2009). Also see "Regulatory Classification of Special-Status Species" in Section 5.8, Fisheries.

5.7.3 Environmental Setting

This section describes the habitat types and resources in the program area. Most of the habitat in irrigated lands in the program area is agricultural or managed wetland, although some natural terrestrial habitats also could be affected, such as annual grasslands. The following sections are subdivided into the two main categories of irrigated lands within the program area, agricultural lands and managed wetlands.

Agricultural Lands

Agricultural lands include irrigated lands used for crop production, any man-made structure used for agricultural purposes, and raising livestock. These areas are usually located on flat to gently rolling terrain in all three hydrologic basins of the program area. Habitat types on agricultural lands include cropland, orchard, vineyard, and pasture.

Irrigated croplands typically comprise row crops planted in monocultures. Natural vegetation and weeds are generally eliminated by flood irrigation, tillage, and herbicide application. Orchards and vineyards usually contain single tree, shrub, or vine species planted in rows. A low-growing herbaceous understory or cover crop may be present but is generally managed to control overgrowth. Irrigated pasture consists of perennial grasses and legumes planted for livestock forage, although the vegetation may include native grasses and forbs and weedy non-natives. Pastures are managed to improve forage quality using irrigation, fertilizer application, and weed control. Natural habitats occur adjacent to many agricultural lands, most commonly annual grassland, seasonal wetland, vernal pool, saltbush scrub, riparian woodland, and oak woodland.

Much of the natural communities in the Central Valley have been largely replaced by agricultural habitats, with varying effects to wildlife. The intensive management of irrigated lands, especially croplands, orchards, and vineyards, including disking, crop rotation, and the use of pesticides and herbicides, further reduces the value of these agricultural lands for wildlife. However, many wildlife species have adapted to agricultural lands and use them for foraging and breeding. Compared to other agricultural crops, rice and grain are considered high-value crops for wildlife because many wildlife species, especially water fowl, forage in waste grain fields, and flooded rice fields provide habitat similar to natural wetlands. Irrigated pastures also provide foraging and breeding habitat. Orchards provide moderate-quality habitat because they are used by many species of birds for nesting habitat, but orchards provide only limited foraging habitat for wildlife. Row crops, cotton fields, and vineyards provide low-quality habitat for wildlife species because they are frequently disturbed, and require applications of herbicides and pesticides. Consequently, these croplands provide limited foraging and breeding opportunities and minimal cover.

Managed Wetlands

California wetland ecosystems have been heavily modified by flood control, water storage, and water conveyance projects that altered the natural hydrology of the Central Valley, which once supported over 4 million acres of wetlands (Kwasny et al. 2004:3). Much of the remaining wetlands in the Central Valley are managed by artificial flooding to mimic the natural hydrology of wetland systems. The total acreage of these managed wetlands in the Central Valley watershed, from Modoc National Wildlife Refuge (NWR) in the north to Kern NWR in the south, is approximately 144,000 acres. These wetlands are principally located in the lower elevations of the various subbasins in which they occur. These low areas have traditionally served as the receiving lands for return flows from upland water users.

In the program area, managed wetlands occur in state wildlife areas, in NWRs, and on private lands managed for wildlife habitat. Some of the wildlife areas and refuges also include sensitive natural communities, such as riparian habitats and vernal pools (at the San Luis NWR Complex) adjacent to the managed wetlands. Details of the existing managed wetlands in each subbasin of the program area, including types, acreages, and current management practices, are provided in Chapter 5 of the ECR.

The DFG Lands Program has public lands programs to support, restore, and enhance wetlands for wildlife habitat, as well as several private lands incentive programs, including the California Waterfowl Habitat Program (CWHP) for habitat management, the Permanent Wetland Easement Program for state purchase of farming and development rights, and the Landowner Incentives Program for enhancing habitat (DFG no date). The CWHP includes over 29,000 acres of habitat for wintering and breeding waterfowl in the Tulare Basin, the Grassland Bypass Project Area, Suisun Marsh, and Sacramento Valley (DFG no date). The program pays private landowners to implement management plans that require “moist-soil management” practices, such as spring and summer irrigation, weed abatement to control the spread of invasive plants, and management of uplands and summer wetlands for breeding ducks.

Managed wetlands typically are flooded using delivered canal water, water diverted from rivers or sloughs, or groundwater from deep well pumping (Kwasny et al. 2004:3). Without this flooding, most managed wetland areas would remain as upland vegetation or as seasonally wet areas only in heavy rain years. Infrastructure in managed wetlands includes levees, water control structures, and other features to control the timing, depth, and duration of flooding. The control of flooding allows implementation of habitat management practices to create wildlife habitat, including vegetation for food and cover, adequate water quality, and breeding and resting sites. Maintenance of infrastructure in managed wetlands includes activities such as levee inspection and repair; water control structure inspection, repair, and cleaning; ditch and swale cleaning; and pump tests and repair (Kwasny et al. 2004:21–22). All of these maintenance activities result in routine disturbance of vegetation in managed wetlands.

In the Central Valley, managed wetlands are described by three main flooding regimes distinguished by timing and duration: seasonal, semi-permanent, and permanent (Kwasny et al. 2004:4).

Seasonal Wetlands

Seasonal wetlands comprise approximately from 85 to 95 percent of all managed wetlands (Kwasny et al. 2004:4). They are initially flooded between August and October, remain flooded throughout winter, and are drawn down in spring—between March and May. Spring drawdown concentrates invertebrates in receding wetlands to provide forage for migratory waterfowl and shorebirds, and exposes mudflats on which wetland plants germinate. Following drawdown, most seasonal wetlands remain dry in summer. Of the managed wetland types, seasonal wetlands typically have the greatest diversity of vegetation and water depths, number of species (both plant and animal), and abundance of migratory birds and other wetland-dependent wildlife on an annual basis.

Irrigated seasonal wetlands receive water one to three times between April and June each year, depending on the food plants desired and geographic location of the area. These wetlands, along with non-irrigated seasonal wetlands, are then flooded in early fall and maintained through winter until February or March, when they are gradually drawn down to achieve desired soil temperatures for germination of desired food plants. Plant species promoted in managed seasonal wetlands include non-native species such as swamp timothy (*Crypsis schoenoides*) and watergrass (*Echinochloa crus-galli*) and native species such as smartweed (*Polygonum lapathifolium*). Irrigation also may be used to control plant species that are undesirable for wildlife, such as cocklebur (*Xanthium strumatum*) (Kwasny et al. 2004:4). Depending on spring weather conditions, the type of wetland vegetation that is being encouraged, or the need to discourage certain species, irrigation can occur any time from May through July and can vary in both frequency and duration. Following irrigation, when soils are dry enough to support heavy equipment, managed wetlands are disced and mowed for weed control and enhancement of seed-producing wetland plants for waterfowl (Kwasny et al. 2004:4, 18–20).

Semi-Permanent and Permanent Wetlands

Semi-permanent and permanent wetlands are less common than managed seasonal wetlands and comprise only from 5 to 15 percent of the total managed wetlands in the Central Valley (Kwasny et al. 2004:5). Semi-permanent wetlands, also known as "brood ponds," typically are flooded from

October through mid-July, and permanent wetlands are flooded year-round. These habitat types are often characterized by a combination of open water, emergent vegetation, and submergent aquatic vegetation. Common plant species in semi-permanent and permanent wetlands include native species, such as cattails (*Typha* spp.), tules (*Schoenoplectus* [*Scirpus*] *acutus*), other bulrushes, horned-pondweed (*Zannichellia palustris*), and sago pondweed (*Stuckenia pectinata* [*Potamogeton pectinatus*]). These wetlands provide important habitat for resident wildlife, and provide breeding and molting habitats for waterfowl at a time of year when most seasonal wetlands are dry (Kwasny et al. 2004:5). The semi-permanent wetlands are usually dewatered for 2–3 months around July of each year and may be re-flooded for the fall and winter waterfowl migrations. Permanent wetlands typically are drawn down only every 3–5 years to recycle nutrients, increase productivity, and, in some cases, control undesirable fish populations (e.g., carp). Both types of wetlands are commonly disced, mowed, burned, hayed, or grazed to control vegetation (Kwasny et al. 2004:5. 18–20).

Special-Status Species

Plants

Tables 5.7-1a, 5.7-1b, and 5.7-1c are specific for each of the three hydrologic basins and include status, location, and habitat information for state and federally listed plant species documented as occurring in the program area counties (CNDDB 2009). Several hundred more non-listed special-status plant species are documented by the CNDDB as occurring in the program area, but they are too numerous for inclusion in a table.

Agricultural Lands

Special-status plants would not be expected to occur in irrigated croplands, orchards, or vineyards because they are usually eliminated by cultivation practices. They are also unlikely to occur in irrigated pastures because of the habitat modification and intense grazing. The habitats most similar to irrigated pasture are grasslands, including annual grassland and meadows, which may support vernal pools and other seasonal wetlands.

Managed Wetlands

Although managed seasonal wetlands provide suitable hydrologic conditions for special-status seasonal wetland and vernal pool species, the routine disturbances experienced in managed wetlands for maintenance activities make these areas unlikely to support special-status plants. Similarly, the managed semi-permanent wetlands could provide suitable hydrological conditions for special-status freshwater marsh species but are unlikely to support these species due to ongoing disturbances of the habitat.

Wildlife

Tables 5.7-2a, 5.7-2b, and 5.7-2c are specific for each of the three hydrologic basins and include status, location, and habitat requirements of the special-status wildlife species that could occur within them. Documentation of occurrence of these species was based on the CNDDB (2009).

Agricultural Lands

Many special-status wildlife species could occur on irrigated lands in the Central Valley. Grain crops and irrigated pastures provide important foraging habitat for many special-status birds, including greater sandhill crane, Swainson's hawk, burrowing owls, and other raptors. Flooded rice fields provide aquatic habitat for giant garter snakes.

Managed Wetlands

Managed seasonal wetlands provide suitable hydrologic conditions for seasonal wetland and vernal pool species and could support special-status wildlife species that are adapted to these habitat conditions. Similarly, the managed semi-permanent wetlands could provide suitable hydrological conditions for special-status wildlife species that are adapted to these habitat conditions.

Table 5.7-1a. State-Listed and Federally Listed Plants with Potential to Occur in the Program Area – Sacramento Valley Basin

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Mcdonald's rock-cress *Arabis macdonaldiana*	E/E/1B.1	North Coast Ranges and Klamath Ranges: Mendocino, Siskiyou, Trinity, Del Norte County; Josephine County, Oregon	Serpentine soils in lower montane coniferous forest, North Coast coniferous forest, and upper montane coniferous forest; 135–1,800 meters	May–July
Clara Hunt's milk-vetch *Astragalus claranus*	E/T/1B.1	Southern portion of the North Coast Ranges: endemic to Napa and Sonoma Counties	Serpentine, volcanic, rocky, or clay soils in chaparral openings, cismontane woodland, valley and foothill grassland; 75–275 meters	March–May
Indian Valley brodiaea *Brodiaea coronaria* ssp. *rosea*	–/E/1B.1	Inner north Coast Ranges: Colusa, Glenn, Lake, and Tehama Counties	Serpentine soils in closed-cone coniferous forest, chaparral, cismontane woodland, valley and foothill grassland; 335–1,450 meters	May–June
Siskiyou mariposa-lily *Calochortus persistens*	C/R/1B.2	Northeastern Klamath Ranges in Siskiyou County; also adjacent Oregon	Rocky areas in lower montane coniferous forest, North Coast coniferous forest; 1,000–1,860 meters	June–July
Stebbins' morning-glory *Calystegia stebbinsii*	E/E/1B.1	Northern Sierra Nevada Foothills with reported occurrences in El Dorado and Nevada Counties	Serpentine or gabbroic soils in chaparral openings, cismontane woodland; 185–730 meters	(March) April–July
Tiburon paintbrush *Castilleja affinis* ssp. *neglecta*	E/T/1B.2	San Francisco Bay Area: Marin, Napa, and Santa Clara Counties	Serpentine grasslands; 60–400 meters	April–June
Pine Hill ceanothus *Ceanothus roderickii*	E/R/1B.2	Endemic to El Dorado County	Serpentine or gabbro soils in chaparral or cismontane woodland; 260–630 meters	April–June
Hoover's spurge *Chamaesyce hooveri*	T/–/1B.2	Central Valley from Butte to Tehama Counties	Below high water marks of large northern hardpan and volcanic vernal pools; 25–250 meters	July–September (uncommonly October)
Ashland thistle *Cirsium ciliolatum*	–/E/2.1	Klamath Ranges, Siskiyou County; Oregon	Cismontane woodland, valley and foothill grassland; 800–1,400 meters	June–August
Suisun thistle *Cirsium hydrophilum* var. *hydrophilum*	E/–/1B.1	Suisun Marsh, Solano County	Salt marshes and swamps; at sea level	July–September

Common and Scientific Name	Legal Status[a] Federal/State/CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Soft bird's-beak *Cordylanthus mollis* ssp. *mollis*	E/R/1B.2	Northern Central Coast with occurrences in Contra Coasta, Marin*, Napa, Sacramento*, Solano, and Sonoma* Counties	Coastal salt marshes and swamps; below 3 meters	July–November
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B.1	Livermore Valley and scattered locations in the Central Valley from Colusa to Fresno Counties	Alkaline grassland, alkali meadow, chenopod scrub; 5–155 meters	May–October
Tracy's eriastrum *Eriastrum tracyi*	–/R/1B.2	Colusa, Glenn, Santa Clara, Tehama, and Trinity Counties	Chaparral, cismontane woodland, on gravelly shale or clay soils, often in open areas; 315–975 meters	June–July
Trinity buckwheat *Eriogonum alpinum*	–/E/1B.2	Siskiyou and Trinity Counties	On serpentinite in rocky areas in alpine boulder and rock field, subalpine and upper montane coniferous forests; 2,185–2,900 meters	June–September
Ione buckwheat *Eriogonum apricum* var. *apricum*	E/E/1B.1	Amador and Sacramento Counties	Openings in chaparral on Ione soil; 60–145 meters	July–October
Loch Lomond button-celery *Eryngium constancei*	E/E/1B.1	Lake, Napa, and Sonoma Counties: Loch Lomond and Diamond Mountain	Volcanic ash flow vernal pools; 460–855 meters	April–June
Pine Hill flannelbush *Fremontodendron decumbens*	E/R/1B.2	Pine Hill area in El Dorado County, Grass Valley vicinity in Nevada County, Yuba County	Rocky gabbro or serpentinite soils in chaparral, cismontane woodland; 425–760 meters	April–July
Gentner's fritillary *Fritillaria gentneri*	E/–/1B.1	High Cascade Range in Siskiyou County	Chaparral and cismontane woodland, sometimes on serpentine soils; 1,005–1,120 meters	April–May
El Droado bedstraw *Galium claifornicum* ssp. *sierrae*	E/R/1B.2	Endemic to El Dorado County	On gabbroic soils in chaparral, cismontane woodland, lower montane coniferous forest; 100–585 meters	May–June
Boggs Lake hedge hyssop *Gratiola heterosepala*	–/E/1B.2	Inner North Coast Ranges, central Sierra Nevada foothills, Sacramento Valley, Modoc Plateau	Clay soils in marshes and swamps along lake margins and vernal pools; 10–2,375 meters	April–August

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Lake County western flax *Hesperolinon didymocarpum*	–/E/1B.2	Southern Inner North Coast Ranges, northeast San Francisco Bay region, especially Mt. Diablo: Contra Costa, Napa, and Solano Counties	Chaparral, cismontane woodland, valley and foothill grassland usually on soils derived from serpentinite; 30–900 meters	May–July
Burke's goldfields *Lasthenia burkei*	E/E/1B.1	Lake, Mendocino, and Sonoma Counties	Wet meadows and seeps, vernal pools; 15–600 meters	April–June
Contra Costa goldfields *Lasthenia conjugens*	E/–/1B.1	North Coast, southern Sacramento Valley, San Francisco Bay, South Coast	Mesic areas in cismontane woodland, alkaline playas, valley and foothill grassland, vernal pools; below 470 meters	March–June
Mason's lilaeopsis *Lilaeopsis masonii*	–/R/1B.1	Southern Sacramento Valley, northeastern San Francisco Bay	Riparian scrub, brackish or freshwater marshes and swamps; below 10 meters	April–November
Butte County meadowfoam *Limnanthes floccosa* ssp. *californica*	E/E/1B.1	Endemic to Butte County	Mesic areas in valley and foothill grassland, vernal pools and swales; 46–930 meters	March–May
Sebastopol meadowfoam *Limnanthes vinculans*	E/E/1B.1	Napa? and Sonoma Counties	Vernal pools, vernally mesic grasslands and wet meadows; 15–305 meters	April–May
Milo Baker's lupine *Lupinus milo-bakeri*	–/T/1B.1	North Coast Ranges in Colusa and Mendocino Counties	Valley and foothill grasslands, along streams, ditches, and often along roads in foothill woodlands; 395–430 meters	June–September
Few-flowered navarretia *Navarretia leucocephala* ssp. *pauciflora*	E/T/1B.1	Lake and Napa Counties	Volcanic ash/mud flow vernal pools; 400–855 meters	May–June
Many-flowered navarretia *Navarretia leucocephala* ssp. *plieantha*	E/E/1B.1	Lake and Sonoma Counties	Volcanic ash/mud flow vernal pools; 30–950 meters	May–June
Colusa grass *Neostapfia colusana*	T/E/1B.1	Central Valley with scattered occurrences from Colusa to Merced Counties	Adobe soils of vernal pools; 5–200 meters	May–August
San Joaquin Valley Orcutt grass *Orcuttia inaequalis*	T/E/1B.1	Scattered locations along east edge of the San Joaquin Valley and adjacent foothills, from Stanislaus County to Tulare County	Vernal pools; 10–755 meters	April–September
Hairy Orcutt grass *Orcuttia pilosa*	E/E/1B.1	Scattered locations along east edge of Central Valley and adjacent foothills from Tehama to Merced Counties	Vernal pools; 46–200 meters	May–September

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Inner North Coast Ranges, Cascade Range foothills, Sacramento County	Vernal pools; 35–1,760 meters	May–September (uncommonly October)
Sacramento Orcutt grass *Orcuttia viscida*	E/E/1B.2	Known only from Sacramento County	Vernal pools; 30–100 meters	April–July
Layne's ragwort *Packera layneae*	T/R/1B.2	Northern Sierra Nevada Foothills, Butte, El Dorado, Tuolumne, and Yuba Counties	Rocky serpentinite or gabbro soils in chaparral and foothill woodland; 200–1,000 meters	April–August
Yreka phlox *Phlox hirsuta*	E/E/1B.2	Siskiyou County	Lower and upper montane coniferous forest, on serpentinite talus slopes; 820–1,500 meters	April–June
Calistoga popcorn-flower *Plagiobothrys strictus*	E/T/1B.1	Napa County, near Calistoga	Alkaline areas near thermal springs; 90–160 meters	March–June
Napa blue grass *Poa napensis*	E/E/1B.1	Napa County, near Calistoga	Alkaline areas near thermal springs; 100–200 meters	May–August
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B.1	Central Sierra Nevada foothills, eastern San Joaquin Valley	Clay soils in cismontane woodland, valley and foothill grassland; 15–150 meters	March–April
Tahoe yellow cress *Rorippa subumbellata*	C/E/1B.1	Lake Tahoe Basin: El Dorado, Nevada*, and Placer Counties; also adjacent Nevada	Lower montane coniferous forest, meadows and seeps, on decomposed granitic beaches; 1,895–1,900 meters	May–September
Lake County stonecrop *Sedella leiocarpa*	E/E/1B.1	Known from fewer than five occurrences in Lake County	Vernally mesic depressions on volcanic outcrops in cismontane woodland, valley and foothill grassland, vernal pools; 365–790 meters	April–May
Keck's checkerbloom *Sidalcea keckii*	E/–/1B.1	Fresno and Tulare Counties	Serpentine clay soils in cismontane woodland, valley and foothill grassland; 120–425 meters	April–May
Scadden Flat checkerbloom *Sidalcea stipularis*	–/E/1B.1	Two occurrences near Scadden Flat, Nevada County	Freshwater seep, wet meadow, montane freshwater marshes and swamps; 700–730 meters	July–August
Red Mountain catchfly *Silene campanulata* ssp. *campanulata*	–/E/4.2	North Coast Ranges: Colusa, Glenn, Mendocino, Shasta, Tehama, and Trinity Counties	On soils derived from serpentine substrates on rocky slopes in Jeffrey pine forest and mixed chaparral; 425–2,085 meters	April–July

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Showy rancheria clover *Trifolium amoenum*	E/–/1B.1	Coast Ranges foothills in the San Francisco Bay region, currently known from only two recent occurrences in Marin County	Valley and foothill grassland, coastal bluff scrub, sometimes on serpentinite soils; 5–415 meters	April–June
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Scattered distribution along eastern Central Valley and foothills from Shasta to Tulare Counties	Dry vernal pools; 30–1,070 meters	May–July (uncommonly September)
Crampton's tuctoria *Tuctoria mucronata*	E/E/1B.1	Southwestern Sacramento Valley, Solano and Yolo Counties	Mesic areas in valley and foothill grassland, vernal pools; 5–10 meters	April–August

[a] Status explanations:

Federal

C = candidate for listing under the federal Endangered Species Act.
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
– = no listing.

State

E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
R = listed as rare under the California Native Plant Protection Act (this category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
– = no listing.

California Native Plant Society (CNPS)

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
4 = List 4 species: limited distribution and on a watch list.
0.1 = seriously endangered in California.
0.2 = fairly endangered in California.
* = presumed extirpated from that county.
? = occurrence within county needs to be confirmed.

[b] Floristic provinces as defined in Hickman 1993.

Table 5.7-1b. State-Listed and Federally Listed Plants with Potential to Occur in the Program Area – San Joaquin Valley Basin

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Yosemite onion *Allium yosemitense*	–/R/1B.3	Central Sierra Nevada: Mariposa and Tuolumne Counties	Rocky, metamorphic or granite soils in broadleaved upland forest, chaparral, cismontane woodland, lower montane coniferous forest; 535–2,200 meters	April–July
Large-flowered fiddleneck *Amsinckia grandiflora*	E/E/1B.1	Historically known from Mt. Diablo foothills in Alameda, Contra Costa, and San Joaquin Counties; currently known from three natural occurrences	Cismontane woodland, valley and foothill grassland; 275–550 meters	April–May
Ione manzanita *Arctostaphylos myrtifolia*	T/–/1B.2	Central Sierra Nevada Foothills, Amador and Calaveras Counties	Acidic, lone soil, clay or sandy soils in chaparral and cismontane woodland; 60–580 meters	November–February
Pallid manzanita *Arctostaphylos pallida*	T/E/1B.1	Eastern San Francisco Bay area, Sobrante and Huckleberry Ridges, Berkeley-Oakland Hills in Alameda and Contra Costa Counties	On siliceous sandy or gravelly shales in broadleaved upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub; 185–465 meters	December–March
Chinese Camp brodiaea *Brodiaea pallida*	T/E/1B.1	Central Sierra Nevada Foothills, near Chinese Camp, Calaveras and Tuolumne Counties	Serpentine soils in valley and foothill grassland, vernal swales and streambeds; 385 meters	May–June
Mariposa pussypaws *Calyptridium pulchellum*	T/–/1B.1	Central Sierra Nevada; Fresno, Madera, and Mariposa Counties	Sandy or gravelly areas on granitic soils in chaparral, cismontane woodland; 400–1,220 meters	April–August
San Benito evening-primrose *Camissonia benitensis*	T/–/1B.1	Inner South Coast Ranges with occurrences in Fresno and San Benito Counties	Serpentine alluvium, clay or gravelly soils in chaparral, cismontane woodland, valley and foothill grassland; 600–1,280 meters	April–June
Tompkins' sedge *Carex tompkinsii*	–/R/4.3	Central Sierra Nevada Foothills, southern high Sierra Nevada in Fresno, Mariposa, and Tuolumne Counties	Sometimes granitic soils in chaparral, cismontane woodland, lower and upper montane coniferous forest; 420–1,830 meters	May–July
Tree-anemone *Carpenteria californica*	–/T/1B.2	Central and southern Sierra Nevada Foothills, Kings and San Joaquin Rivers, Fresno and Madera Counties, Contra Costa and Tehama Counties	Usually granitic soils in chaparral and cismontane woodland; 340–1,340 meters	May–July

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Succulent owl's-clover *Castilleja campestris* ssp. *succulenta*	T/E/1B.2	Eastern edge of San Joaquin Valley and adjacent foothills, from Stanislaus to Fresno Counties	Vernal pools, often on acidic soils; 50–750 meters	April–May
California jewel-flower *Caulanthus californicus*	E/E/1B.2	Historically common in western San Joaquin Valley and interior foothills; currently known from scattered locations in Fresno, Kern, Santa Barbara, and San Luis Obispo Counties	Sandy soils in valley and foothill grassland, chenopod scrub, and pinyon-juniper woodland; 70–1,000 meters	February–May
Hoover's spurge *Chamaesyce hooveri*	T/–/1B.2	Central Valley from Butte to Tehama Counties	Below high water marks of large northern hardpan and volcanic vernal pools; 25–250 meters	July–September (uncommonly October)
Robust spineflower *Chorizanthe robusta* var. *robusta*	E/–/1B.1	Coastal central California, from Marin to Monterey Counties	Sandy or gravelly areas in coastal scrub, coastal dunes, and openings in cismontane woodland; below 300 meters	April–September
Presidio clarkia *Clarkia franciscana*	E/E/1B.1	San Francisco Bay, Presidio, Oakland Hills: Alameda and San Francisco Counties	Serpentine grassland, coastal scrub; 25–335 meters	May–July
Merced clarkia *Clarkia lingulata*	–/E/1B.1	Central Sierra Nevada Foothills, Merced River Canyon, Mariposa County	Closed-cone coniferous forest, chaparral, cismontane woodland; 400–455 meters	May–June
Soft bird's-beak *Cordylanthus mollis* ssp. *mollis*	E/R/1B.2	Northern Central Coast with occurrences in Contra Costa, Marin*, Napa, Sacramento*, Solano, and Sonoma* Counties	Coastal salt marshes and swamps; below 3 meters	July–November
Mt. Diablo bird's-beak *Cordylanthus nidularius*	–/R/1B.1	Known from one occurrence on Mount Diablo	Chaparral, in grassy or rocky areas within serpentine chaparral; 600–800 meters	July–August
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B.1	Livermore Valley and scattered locations in the Central Valley from Colusa to Fresno Counties	Alkaline grassland, alkali meadow, chenopod scrub; 5–155 meters	May–October
Tracy's eriastrum *Eriastrum tracyi*	–/R/1B.2	Colusa, Glenn, Santa Clara, Tehama, and Trinity Counties	Chaparral, cismontane woodland, on gravelly shale or clay soils, often in open areas; 315–975 meters	June–July
Ione buckwheat *Eriogonum apricum* var. *apricum*	E/E/1B.1	Amador and Sacramento Counties	Openings in chaparral on Ione soil; 60–145 meters	July–October

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Irish Hill buckwheat *Eriogonum apricum* var. *prostratum*	E/E/1B.1	Amador County	Openings in chaparral on Ione soil; 90–120 meters	June–July
Congdon's woolly sunflower *Eriophyllum congdonii*	–/R/1B.2	Known only from the Merced River drainage in Mariposa County	On rocky metamorphic soils in valley and foothill grassland, chaparral, cismontane woodland, lower montane coniferous forest; 500–1,900 meters	April–June
Delta button-celery *Eryngium racemosum*	–/E/1B.1	San Joaquin River delta, floodplains, and adjacent Sierra Nevada Foothills: Calaveras, Contra Costa, Merced, San Joaquin*, and Stanislaus Counties	Riparian scrub in seasonally inundated depressions on clay soils; 3–30 meters	June–September
Boggs Lake hedge hyssop *Gratiola heterosepala*	–/E/1B.2	Inner North Coast Ranges, central Sierra Nevada foothills, Sacramento Valley, Modoc Plateau	Clay soils in marshes and swamps along lake margins and vernal pools; 10–2,375 meters	April–August
Santa Cruz tarplant *Holocarpha macradenia*	T/E/1B.2	Coastal slope of the Santa Cruz Mountains, Monterey and Santa Cruz Counties	Coastal terrace grasslands, coastal scrub, often on light sandy to sandy clay soils; 10–220 meters	June–October
Contra Costa goldfields *Lasthenia conjugens*	E/–/1B.1	North Coast, southern Sacramento Valley, San Francisco Bay, South Coast	Mesic areas in cismontane woodland, alkaline playas, valley and foothill grassland, vernal pools; below 470 meters	March–June
Congdon's lewisia *Lewisia congdonii*	–/R/1B.3	Fresno and Mariposa Counties	On rocky granitic or metamorphic, mesic substrates in chaparral, cismontane woodland, lower and upper montane coniferous forest; 500–2,800 meters	April–June
Mason's lilaeopsis *Lilaeopsis masonii*	–/R/1B.1	Southern Sacramento Valley, northeastern San Francisco Bay	Riparian scrub, brackish or freshwater marshes and swamps; below 10 meters	April–November
Mariposa lupine *Lupinus citrinus* var. *deflexus*	–/T/1B.2	Mariposa County	On sandy granitic soils in chaparral, cismontane woodland; 400–610 meters	April–May
San Joaquin woollythreads *Monolopia congdonii*	E/–/1B.2	Carrizo Plain and western San Joaquin Valley from San Benito to Kern Counties	Saltbush scrub, sandy soils in valley and foothill grassland, on flats in alkaline or loamy soils; 60–800 meters	February–May
Colusa grass *Neostapfia colusana*	T/E/1B.1	Central Valley with scattered occurrences from Colusa to Merced Counties	Adobe soils of vernal pools; 5–200 meters	May–August

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
San Joaquin Valley Orcutt grass *Orcuttia inaequalis*	T/E/1B.1	Scattered locations along east edge of the San Joaquin Valley and adjacent foothills, from Stanislaus to Tulare Counties	Vernal pools; 10–755 meters	April–September
Hairy Orcutt grass *Orcuttia pilosa*	E/E/1B.1	Scattered locations along east edge of Central Valley and adjacent foothills from Tehama to Merced Counties	Vernal pools; 46–200 meters	May–September
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Inner North Coast Ranges, Cascade Range foothills, Sacramento County	Vernal pools; 35–1,760 meters	May–September (uncommonly October)
Sacramento Orcutt grass *Orcuttia viscida*	E/E/1B.2	Known only from Sacramento County	Vernal pools; 30–100 meters	April–July
Layne's ragwort *Packera layneae*	T/R/1B.2	Northern Sierra Nevada Foothills, Butte, El Dorado, Tuolumne, and Yuba Counties	Rocky serpentinite or gabbro soils in chaparral and foothill woodland; 200–1,000 meters	April–August
San Francisco popcorn-flower *Plagiobothrys diffusus*	–/E/1B.1			
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B.1	Central Sierra Nevada foothills, eastern San Joaquin Valley	Clay soils in cismontane woodland, valley and foothill grassland; 15–150 meters	March–April
San Joaquin adobe sunburst *Pseudobahia peirsonii*	T/E/1B.1	Fresno, Kern, and Tulare Counties	Cismontane woodland, valley and foothill grassland, on adobe clay soils; 90–800 meters	March–April
Adobe sanicle *Sanicula maritima*	–/R/1B.1	Coastal Monterey and San Luis Obispo Counties; historically known from the San Francisco Bay area in Alameda* and San Francisco* Counties	Moist clay, serpentinite or ultramafic soils, in meadows and seeps, chaparral, coastal prairie, valley and foothill grassland; 30–240 meters	February–May
Rock sanicle *Sanicula saxatilis*	–/R/1B.2	Contra Costa and Santa Clara Counties	Bedrock outcrops and talus slopes in broad-leafed upland forest, chaparral, valley and foothill grassland, and oak woodland; 620–1,175 meters	April–May
Keck's checkerbloom *Sidalcea keckii*	E/–/1B.1	Fresno and Tulare Counties	Serpentine clay soils in cismontane woodland, valley and foothill grassland; 120–425 meters	April–May

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
California seablite *Suaeda californica*	E/–/1B.1	Morro Bay; San Luis Obispo, San Francisco, and Contra Costa Counties; historically found in the south San Francisco Bay	Margins of tidal salt marsh; below 15 meters	July–October
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Scattered distribution along eastern Central Valley and foothills from Shasta to Tulare Counties	Dry vernal pools; 30–1,070 meters	May–July (uncommonly September)
Red Hills vervain *Verbena californica*	T/T/1B.1	Tuolumne County	Moist areas in cismontane woodland and grassland, usually in serpentinite seeps or creeks; 260–400 meters	May–September

[a] Status explanations:

Federal

C = candidate for listing under the federal Endangered Species Act.
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
– = no listing.

State

E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
R = listed as rare under the California Native Plant Protection Act (this category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
– = no listing.

California Native Plant Society (CNPS)

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
4 = List 4 species: limited distribution and on a watch list.
0.1 = seriously endangered in California.
0.2 = fairly endangered in California.
* = presumed extirpated from that county.
? = occurrence within county needs to be confirmed.

[b] Floristic provinces as defined in Hickman 1993.

Table 5.7-1c. State-Listed and Federally Listed Plants with Potential to Occur in the Program Area – Tulare Lake Basin

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Bakersfield smallscale *Atriplex tularensis*	–/E/1B.1	Southern San Joaquin Valley, Kern Lake bed, Kern County; possible extinct – only remaining occurrence at Kern Lake Preserve now thought to be a form of *A. serenana* and not *A. tularensis*	Valley sink scrub; 90–200 meters	June–October
Kaweah brodiaea *Brodiaea insignis*	–/E/1B.2	Southern Sierra Nevada foothills, Kaweah and Tule River drainages, Tulare County	Granitic or clay soils in cismontane woodland, valley and foothill grassland; 150–1,400 meters	April–June
Mariposa pussypaws *Calyptridium pulchellum*	T/–/1B.1	Central Sierra Nevada; Fresno, Madera, and Mariposa Counties	Sandy or gravelly areas on granitic soils in chaparral, cismontane woodland; 400–1,220 meters	April–August
San Benito evening-primrose *Camissonia benitensis*	T/–/1B.1	Inner South Coast Ranges with occurrences in Fresno and San Benito Counties	Serpentine alluvium, clay or gravelly soils in chaparral, cismontane woodland, valley and foothill grassland; 600–1,280 meters	April–June
Tompkins' sedge *Carex tompkinsii*	–/R/4.3	Central Sierra Nevada foothills, southern high Sierra Nevada in Fresno, Mariposa, and Tuolumne Counties	Sometimes granitic soils in chaparral, cismontane woodland, lower and upper montane coniferous forest; 420–1,830 meters	May–July
Tree-anemone *Carpenteria californica*	–/T/1B.2	Central and southern Sierra Nevada foothills, Kings and San Joaquin Rivers, Fresno and Madera Counties, Contra Costa and Tehama Counties	Usually granitic soils in chaparral and cismontane woodland; 340–1,340 meters	May–July
Succulent owl's-clover *Castilleja campestris* ssp. *succulenta*	T/E/1B.2	Eastern edge of San Joaquin Valley and adjacent foothills, from Stanislaus to Fresno Counties	Vernal pools, often on acidic soils; 50–750 meters	April–May
California jewel-flower *Caulanthus californicus*	E/E/1B.2	Historically common in western San Joaquin Valley and interior foothills; currently known from scattered locations in Fresno, Kern, Santa Barbara, and San Luis Obispo Counties	Sandy soils in valley and foothill grassland, chenopod scrub, and pinyon-juniper woodland; 70–1,000 meters	February–May
Hoover's spurge *Chamaesyce hooveri*	T/–/1B.2	Central Valley from Butte to Tehama Counties	Below high water marks of large northern hardpan and volcanic vernal pools; 25–250 meters	July–September (uncommonly October)

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Springville clarkia *Clarkia springvillensis*	T/E/1B.2	Southern Sierra Nevada foothills, Springville, Tulare County	Chaparral, cismontane woodland, valley and foothill grassland, on granitic soils; 245–1,220 meters	May–July
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B.1	Livermore Valley and scattered locations in the Central Valley from Colusa to Fresno Counties	Alkaline grassland, alkali meadow, chenopod scrub; 5–155 meters	May–October
Mojave tarplant *Deinandra mohavensis*	–/E/1B.3	Kern, Riverside, San Bernardino*, and San Diego Counties	Moist sites in chaparral, coastal scrub, riparian scrub; 640–1,600 meters	July–October (January)
Kern mallow *Eremalche kernensis*	E/–/1B.1	Vicinity of Lokern in Kern and Tulare Counties	Valley sink scrub, saltbush scrub, chenopod scrub, valley and foothill grasslands, on sandy clay-loam soils; 70–1,000 meters	March–May
Tracy's eriastrum *Eriastrum tracyi*	–/R/1B.2	Colusa, Glenn, Santa Clara, Tehama, and Trinity Counties	Chaparral, cismontane woodland, on gravelly shale or clay soils, often in open areas; 315–975 meters	June–July
Striped adobe-lily *Fritillaria striata*	–/T/1B.1	Southeastern San Joaquin Valley, western Sierra Nevada foothills, northern foothills of the Tehachapi Mountains: Kern and Tulare Counties	Blue oak woodland, valley and foothill grassland, usually heavy clay soils; 135–1,455 meters	February–April
Boggs Lake hedge hyssop *Gratiola heterosepala*	–/E/1B.2	Inner North Coast Ranges, central Sierra Nevada foothills, Sacramento Valley, Modoc Plateau	Clay soils in marshes and swamps along lake margins and vernal pools; 10–2,375 meters	April–August
Congdon's lewisia *Lewisia congdonii*	–/R/1B.3	Fresno and Mariposa Counties	On rocky granitic or metamorphic, mesic substrates in chaparral, cismontane woodland, lower and upper montane coniferous forest; 500–2,800 meters	April–June
Father Crowley's lupine *Lupinus padre-crowleyi*	–/R/1B.2	Inyo, Mono, and Tulare Counties	On decomposed granitic substrate in Great Basin scrub, riparian forest, riparian scrub, upper montane coniferous forest; 2,200–4,000 meters	July–August
San Joaquin woollythreads *Monolopia congdonii*	E/–/1B.2	Carrizo Plain and western San Joaquin Valley from San Benito to Kern Counties	Saltbush scrub, sandy soils in valley and foothill grassland, on flats in alkaline or loamy soils; 60–800 meters	February–May

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Blooming Period
Bakersfield cactus *Opunia basilaris* var. *treleasei*	E/E/1B.1	Southern San Joaquin Valley in Kern County	Chenopod scrub, cismontane woodland, valley and foothill grassland; granitic sandy or gravelly soil on bluffs, low hills, and flats; 120–550 meters	April–May
San Joaquin Valley Orcutt grass *Orcuttia inaequalis*	T/E/1B.1	Scattered locations along east edge of the San Joaquin Valley and adjacent foothills, from Stanislaus to Tulare Counties	Vernal pools; 10–755 meters	April–September
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B.1	Central Sierra Nevada foothills, eastern San Joaquin Valley	Clay soils in cismontane woodland, valley and foothill grassland; 15–150 meters	March–April
San Joaquin adobe sunburst *Pseudobahia peirsonii*	T/E/1B.1	Fresno, Kern, and Tulare Counties	Cismontane woodland, valley and foothill grassland, on adobe clay soils; 90–800 meters	March–April
Keck's checkerbloom *Sidalcea keckii*	E/–/1B.1	Fresno and Tulare Counties	Serpentine clay soils in cismontane woodland, valley and foothill grassland; 120–425 meters	April–May
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Scattered distribution along eastern Central Valley and foothills from Shasta to Tulare Counties	Dry vernal pools; 30–1,070 meters	May–July (uncommonly September)

[a] Status explanations:

Federal

C = candidate for listing under the federal Endangered Species Act.
E = listed as endangered under the federal Endangered Species Act.
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– = no listing.

State

E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
R = listed as rare under the California Native Plant Protection Act (this category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
– = no listing.

California Native Plant Society (CNPS)

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
4 = List 4 species: limited distribution and on a watch list.
0.1 = seriously endangered in California.

0.2 = fairly endangered in California.
0.3 = not very threatened in California (low degree/immediacy of threats or no current threats known).
* = presumed extirpated from that county.
? = occurrence within county needs to be confirmed.
[b] Floristic provinces as defined in Hickman 1993.

Table 5.7-2a. Special-Status Wildlife Species with Potential to Occur in the Program Area – Sacramento Valley Basin

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Invertebrates			
Conservancy fairy shrimp *Branchinecta conservatio*	E/–/–	Disjunct occurrences in Solano, Merced, Tehama, Ventura, Butte, and Glenn Counties	Large, deep vernal pools in annual grasslands
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–/–	Central Valley, central and south Coast Ranges from Tehama to Santa Barbara Counties; isolated populations also in Riverside County.	Common in vernal pools; also found in sandstone rock outcrop pools
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–/–	Streamside habitats below 3,000 feet throughout the Central Valley	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant
Delta green ground beetle *Elaphrus viridus*	T/–/–	Restricted to Olcott Lake and other vernal pools at Jepson Prairie Preserve, Solano County	Sparsely vegetated edges of vernal lakes and pools; occur up to 250 feet from pools
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–/–	Shasta County south to Merced County	Vernal pools and ephemeral stock ponds
Shasta crayfish *Pacifastacus fortis*	E/E/–	Only in Shasta County in the Pit River drainage and two tributary systems: Fall River and Hat Creek	Clear, cool, spring-fed lakes, rivers, and streams; usually at or near the spring inflow site
Amphibians			
California tiger salamander *Ambystoma californiense*	T/SSC/–	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to northeastern San Luis Obispo County	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy
Western tailed-frog *Ascaphus truei*	–/SSC/–	In California, from coastal Mendocino County north to the Oregon border and east to Shasta County	Permanent streams with low temperatures in forests dominated by Douglas fir, redwood, Sitka spruce, Ponderosa pine, and western hemlock

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Foothill yellow-legged frog *Rana boylii*	–/SSC/–	In the Klamath, Cascade, north Coast, south Coast, Transverse, and Sierra Nevada Ranges up to approximately 6,000 feet	Creeks or rivers in woodland, forest, mixed chaparral, and wet meadow habitats with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby
California red-legged frog *Rana draytonii*	T/SSC/–	Along the coast and coastal mountain ranges of California from Marin to San Diego Counties and in the Sierra Nevada from Tehama to Fresno Counties	Permanent and semi-permanent aquatic habitats, such as creeks and coldwater ponds, with emergent and submergent vegetation; may estivate in rodent burrows or cracks during dry periods
Western spadefoot *Spea hammondii*	–/SSC/–	Sierra Nevada foothills, Central Valley, Coast Ranges, coastal counties in southern California	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands
Reptiles			
Western pond turtle *Emys marmorata*	–/SSC/–	From the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of the Sierra Nevada	Ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests
Giant garter snake *Thamnophis gigas*	T/T/–	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno	Sloughs, canals, low-gradient streams and freshwater marsh habitats with a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter
Birds			
Tricolored blackbird *Agelaius tricolor*	–/SSC/–	Permanent resident in the Central Valley from Butte to Kern Counties; breeds at scattered coastal locations from Marin County south to San Diego County and at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grain fields; habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Short-eared owl *Asio flammeus*	–/SSC/–	Permanent resident along the coast from Del Norte to Monterey Counties although very rare in summer north of San Francisco Bay, in the Sierra Nevada north of Nevada County, in the plains east of the Cascades, and in Mono County; small, isolated populations	Freshwater and salt marshes, lowland meadows, and irrigated alfalfa fields; needs dense tules or tall grass for nesting and daytime roosts
Long-eared owl *Asio otus*	–/SSC/–	Permanent resident east of the Cascade Range from Placer County north to the Oregon border, east of the Sierra Nevada from Alpine to Inyo Counties; scattered breeding populations along the coast and in southeastern California; winters throughout the Central Valley and southeastern California	Nests in abandoned crow, hawk, or magpie nests usually in dense riparian stands of willows, cottonwoods, live oaks, or conifers
Western burrowing owl *Athene cunicularia*	–/SSC/–	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along the south coast	Level, open, dry, heavily grazed or low stature grassland or desert vegetation with available burrows
Redhead *Aythya Americana*	–/SSC/–	Permanent resident and winter migrant in the Central Valley and central California foothills	Usually nests in freshwater wetlands with tall emergent vegetation interspersed with areas of deep, open water; in winter and migration, forages and rests on large, deep bodies of water and may form rafts far from shore
Swainson's hawk *Buteo swainsoni*	–/T/–	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley; highest nesting densities occur near Davis and Woodland, Yolo County	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields
Mountain plover *Charadrius montanus*	–/SSC/–	Does not breed in California; in winter, found in the Central Valley south of Yuba County; along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties; and in parts of Imperial, Riverside, Kern, and Los Angeles Counties	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grain fields
Black tern *Chlidonias niger*	–/SSC/–	Migrant and breeder in the northeastern plateau and portions of the Central Valley	Nests in dense wetland vegetation; uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Northern harrier *Circus cyaneus*	–/SSC/–	Occurs throughout lowland California; has been recorded in fall at high elevations	Nests and forages in grasslands, meadows, marshes, and seasonal and agricultural wetlands
Western yellow-billed cuckoo *Coccyzus americanus*	C/E/–	Nests along the upper Sacramento, lower Feather, south fork of the Kern, Amargosa, Santa Ana, and Colorado Rivers	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub jays are abundant
Yellow warbler *Dendroica petechia brewsteri*	–/SSC/–	Nests over all of California except the Central Valley, the Mojave Desert region, and high altitudes along the eastern side of the Sierra Nevada; winters along the Colorado River and in parts of Imperial and Riverside Counties; two small permanent populations in San Diego and Santa Barbara Counties	Nests in riparian areas dominated by willows, cottonwoods, sycamores, or alders or in mature chaparral; may also use oaks, conifers, and urban areas near stream courses
White-tailed kite *Elanus leucurus*	–/FP/–	Lowland areas west of the Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging
Greater sandhill crane *Grus canadensis tabida*	–/T/–	Breeds in Siskiyou, Modoc, Lassen, Plumas, and Sierra Counties; winters in the Central Valley, southern Imperial County, Lake Havasu National Wildlife Refuge, and the Colorado River Indian Reserve	Summers in open terrain near shallow lakes or freshwater marshes; winters in plains and valleys near bodies of fresh water
Bald eagle *Haliaeetus leucocephalus*	–/E, FP/–	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin; re-introduced into central coast; winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierra Nevada, and east of the Sierra Nevada south of Mono County	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean
Yellow-breasted chat *Icteria virens*	–/SSC/–	Nests locally in coastal mountains and Sierra Nevada foothills, east of the Cascades in northern California, along the Colorado River, and very locally inland in southern California	Nests in dense riparian habitats dominated by willows, alders, Oregon ash, tall weeds, blackberry vines, and grapevines

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
California black rail *Laterallus jamaicensis coturniculus*	–/T, FP/–	Permanent resident in the San Francisco Bay and eastward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations
American white pelican *Pelecanus erythrorhynchos*	–/SSC/–	In large water bodies throughout the state	Year-round in California range, winters along coast, and breeds only inland; breeds in multi-species assemblages of colonial nesters along lakes; nests on ground on earthen, sandy, and rocky islands or (rarely) peninsulas and (locally) on floating tule-mat islands; forages in shallow inland waters, such as open areas in marshes and along lake or river edges; wintering and non-breeding feed in shallow coastal marine habitats
Bank swallow *Riparia riparia*	–/T/–	Along the Sacramento River from Tehama to Sacramento Counties, along the Feather and lower American Rivers, in the Owens Valley; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou Counties; small populations near the coast from San Francisco County to Monterey County	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	–/SSC/–	Locally numerous in the Klamath Basin, Modoc Plateau, Great Basin desert, and large mountain valleys in northeastern California and in the San Joaquin Valley; common breeders in the Colorado River valley, the Salton Sink, and the western Mojave Desert; scarce in the Sacramento Valley and along the southern coast in Los Angeles, Riverside, and San Bernardino Counties	Nests in marshes with tall emergent vegetation, such as tules or cattails, generally in open areas and edges over relatively deep water; breeding marshes often on edges of deep water bodies, such as lakes, reservoirs, and larger ponds

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Mammals			
Pallid bat *Antrozous pallidus*	–/SSC/WBWG: High priority	Throughout California except in the high Sierra, from Shasta to Kern Counties and the northwest coast, primarily at lower and mid elevations	A variety of habitats from desert to coniferous forest but most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California and oak woodland, grassland, and desert scrub in southern California; relies heavily on trees for roosts
Townsend's big-eared bat *Corynorhinus townsendii pallescens*	–/SSC/–	Klamath Mountains, Cascades, Sierra Nevada, Central Valley, Transverse and Peninsular Ranges, Great Basin, and the Mojave and Sonora Deserts	Requires caves, tunnels, buildings, or other human-made structures for roosting; gleans insects from brush or trees and feeds along habitat edges
Hoary bat *Lasurius cinerius*	–/SSC/–	Throughout California from sea level to 13,200 feet	Primarily found in forested habitats but also found in riparian areas and in park and garden settings in urban areas; day roosts within foliage of trees
Western red bat *Lasiurus blossevillii*	–/SSC/WBWG: High priority	Scattered throughout much of California at lower elevations	Found primarily in riparian and wooded habitats but occurs at least seasonally in urban areas; day roosts in trees within the foliage; found in fruit orchards and sycamore riparian habitats in the Central Valley

[a] Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

C = candidate species for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded.

– = no listing.

State

E = listed as endangered under the California Endangered Species Act.

T = listed as threatened under the California Endangered Species Act.

FP = fully protected under the California Fish and Game Code.

SSC = species of special concern in California.

– = no listing.

Western Bat Working Group (WBWG)
Available: <http://www.wbwg.org/spp_matrix.html>.
High priority = species are imperiled or at high risk of imperilment.

Table 5.7-2b. Special-Status Wildlife Species with Potential to Occur in the Program Area – San Joaquin Valley Basin

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Invertebrates			
Conservancy fairy shrimp *Branchinecta conservatio*	E/–/–	Disjunct occurrences in Solano, Merced, Tehama, Ventura, Butte, and Glenn Counties	Large, deep vernal pools in annual grasslands
Longhorn fairy shrimp *Branchinecta longiantenna*	E/–/–	Eastern margin of central Coast Ranges from Contra Costa to San Luis Obispo Counties	Small, clear pools in sandstone rock outcrops; clear to moderately turbid clay- or grass-bottomed pools in a variety of habitats
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–/–	Central Valley, central and south Coast Ranges from Tehama to Santa Barbara Counties; isolated populations also in Riverside County	Common in vernal pools; also found in sandstone rock outcrop pools
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–/–	Streamside habitats below 3,000 feet throughout the Central Valley	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–/–	Shasta County south to Merced County	Vernal pools and ephemeral stock ponds
Amphibians			
California tiger salamander *Ambystoma californiense*	T/SSC/–	Central Valley, including the Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to northeastern San Luis Obispo County	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy
Relictual slender salamander *Bratrachoseps relictus*	–/SSC/–	Endemic to southern Sierra Nevada from 540 to 7,350 meters	Habitat requirements are poorly understood

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Kern Canyon slender salamander *Bratrachoseps simatus*	–/T/–	Restricted in range to the Kern River drainage in the southern Sierra Nevada, at elevations ranging between 980 and 6,300 feet	Isolated colonies along streams, ridges, and canyons on moist, shaded, north-facing rocky slopes and shaded tributary canyons in oak and mixed pine-oak woodland; found beneath rocks and rotting logs
Foothill yellow-legged frog *Rana boylii*	–/SSC/–	Occurs in the Klamath, Cascade, North Coast, south Coast, Transverse, and Sierra Nevada Ranges up to approximately 6,000 feet	Creeks or rivers in woodland, forest, mixed chaparral, and wet meadow habitats with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby
California red-legged frog *Rana draytonii*	T/SSC/–	Found along the coast and coastal mountain ranges of California from Marin to San Diego Counties and in the Sierra Nevada from Tehama to Fresno Counties	Permanent and semi-permanent aquatic habitats, such as creeks and coldwater ponds, with emergent and submergent vegetation; may estivate in rodent burrows or cracks during dry periods
Western spadefoot *Spea hammondii*	–/SSC/–	Sierra Nevada foothills, Central Valley, Coast Ranges, and coastal counties in southern California	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands
Reptiles			
Silvery legless lizard *Anniella pulchra pulchra*	–/SSC/–	Along the Coast, Transverse, and Peninsular Ranges from Contra Costa to San Diego Counties, with spotty occurrences in the San Joaquin Valley	Habitats with loose soil for burrowing or thick duff or leaf litter; often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas
Western pond turtle *Emys marmorata*	–/SSC/–	From the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of the Sierra Nevada	Occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests
Giant garter snake *Thamnophis gigas*	T/T/–	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno	Sloughs, canals, low-gradient streams and freshwater marsh habitats with a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Birds			
Tricolored blackbird *Agelaius tricolor*	–/SSC/–	Permanent resident in the Central Valley from Butte to Kern Counties; breeds at scattered coastal locations from Marin County south to San Diego County and at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grain fields; habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony
Short-eared owl *Asio flammeus*	–/SSC/–	Permanent resident along the coast from Del Norte to Monterey Counties although very rare in summer north of San Francisco Bay, in the Sierra Nevada north of Nevada County, in the plains east of the Cascades, and in Mono County; small, isolated populations	Freshwater and salt marshes, lowland meadows, and irrigated alfalfa fields; needs dense tules or tall grass for nesting and daytime roosts
Long-eared owl *Asio otus*	–/SSC/–	Permanent resident east of the Cascade Range from Placer County north to the Oregon border, east of the Sierra Nevada from Alpine to Inyo Counties; scattered breeding populations along the coast and in southeastern California; winters throughout the Central Valley and southeastern California	Nests in abandoned crow, hawk, or magpie nests, usually in dense riparian stands of willows, cottonwoods, live oaks, or conifers
Western burrowing owl *Athene cunicularia hypugea*	–/SSC/–	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Level, open, dry, heavily grazed or low stature grassland or desert vegetation with available burrows
Redhead *Aythya Americana*	–/SSC/–	Permanent resident and winter migrant in the Central Valley and central California foothills	Usually nests in freshwater wetlands with tall emergent vegetation interspersed with areas of deep, open water; in winter and migration, forage and rest on large, deep bodies of water and may form rafts far from shore
Swainson's hawk *Buteo swainsoni*	–/T/–	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley; highest nesting densities occur near Davis and Woodland, Yolo County	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields
Western snowy plover (inland populations) *Charadrius alexandrinus nivosus* (nesting)	T/SSC/–	Nests at inland lakes throughout northeastern, central, and southern California, including Mono Lake and Salton Sea	Barren to sparsely vegetated ground at alkaline or saline lakes, reservoirs, ponds and riverine sand bars; also along sewage, salt-evaporation, and agricultural wastewater ponds

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Mountain plover *Charadrius montanus*	–/SSC/–	Does not breed in California; in winter, found in the Central Valley south of Yuba County; along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties; and in parts of Imperial, Riverside, Kern, and Los Angeles Counties	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grain fields
Black tern *Chlidonias niger*	–/SSC/–	Migrant and breeder in the northeastern plateau and portions of the Central Valley	Nests in dense wetland vegetation; uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields
Northern harrier *Circus cyaneus*	–/SSC	Throughout lowland California; has been recorded in fall at high elevations	Nests and forages in grasslands, meadows, marshes, and seasonal and agricultural wetlands
Western yellow-billed cuckoo *Coccyzus americanus*	C/E/–	Nests along the upper Sacramento, lower Feather, south fork of the Kern, Amargosa, Santa Ana, and Colorado Rivers	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub jays are abundant
Yellow rail *Coturnicops noveboracensis*	–/SSC/–	Large distribution from Alaska and Canada and south through Mexico	Yellow rail prefer wet sedge meadows, along with riparian type habitats.
Black swift *Cypseloides niger*	–/SSC/–	Summer resident and migrant in California range	Restricted to limited potential nesting locations: behind or beside permanent or semi-permanent waterfalls, on perpendicular cliffs near water, and in sea caves; forages for flying ants far from nesting locales over a variety of habitat types
Fulvous whistling duck *Dendrocygna bicolor*	–/SSC/–	Mainly a summer resident and migrant in California range	Found in freshwater and coastal marshes, rice fields, and flooded tall-grass areas with adjacent uplands; feeds nocturnally on seeds of emergent vegetation; ground nester; nests built on dense floating or flooded emergent vegetation
Yellow warbler *Dendroica petechia brewsteri*	–/SSC/–	Nests over all of California except the Central Valley, the Mojave Desert region, and high altitudes along the eastern side of the Sierra Nevada; winters along the Colorado River and in parts of Imperial and Riverside Counties; two small permanent populations in San Diego and Santa Barbara Counties	Nests in riparian areas dominated by willows, cottonwoods, sycamores, or alders or in mature chaparral; may also use oaks, conifers, and urban areas near stream courses

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
White-tailed kite *Elanus leucurus*	–/FP/–	Lowland areas west of the Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging
Greater sandhill crane *Grus canadensis tabida*	–/T/–	Breeds in Siskiyou, Modoc, Lassen, Plumas, and Sierra Counties; winters in the Central Valley, southern Imperial County, Lake Havasu National Wildlife Refuge, and the Colorado River Indian Reserve	Summers in open terrain near shallow lakes or freshwater marshes; winters in plains and valleys near bodies of fresh water
Bald eagle *Haliaeetus leucocephalus*	–/E, FP/–	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin; reintroduced into central coast; winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierra Nevada, and east of the Sierra Nevada south of Mono County	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean
Yellow-breasted chat *Icteria virens*	–/SSC/–	Nests locally in coastal mountains and Sierra Nevada foothills, east of the Cascades in northern California; along the Colorado River; and very locally inland in southern California	Nests in dense riparian habitats dominated by willows, alders, Oregon ash, tall weeds, blackberry vines, and grapevines
California black rail *Laterallus jamaicensis coturniculus*	–/T, FP/–	Permanent resident in the San Francisco Bay and eastward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations
American white pelican *Pelecanus erythrorhynchos*	–/SSC/–	Occurs in large water bodies throughout the state	Year-round in California range, winters along coast and breeds only inland; breeds in multi-species assemblages of colonial nesters along lakes; nests on ground on earthen, sandy, and rocky islands or (rarely) peninsulas and (locally) on floating tule-mat islands; forages in shallow inland waters, such as open areas in marshes and along lake or river edges; wintering and non-breeding feed in shallow coastal marine habitats.

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Least Bell's vireo *Vireo bellii pusillus*	E/E/–	Summers mainly in southern California; recently recorded nesting in the San Joaquin River National Wildlife Refuge in Stanislaus County	Typically inhabits structurally diverse dense riparian woodlands or shrubs along water courses or near open water; nests in shrubs or low trees, usually 3 feet above ground, in a horizontal or down-sloping twig fork, typically near the edge of the thicket; an obligate riparian species during the breeding season
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	–/SSC/–	Locally numerous in the Klamath Basin, Modoc Plateau, Great Basin desert, and large mountain valleys in northeastern California and in the San Joaquin Valley; common breeders in the Colorado River valley, the Salton Sink, and the western Mojave Desert; scarce in the Sacramento Valley and along the southern coast in Los Angeles, Riverside, and San Bernardino Counties	Nests in marshes with tall emergent vegetation, such as tules or cattails, generally in open areas and edges over relatively deep water; breeding marshes often on edges of deep water bodies such as lakes, reservoirs, and or larger ponds
Mammals			
Pallid bat *Antrozous pallidus*	–/SSC/WBWG: High priority	Throughout California except in the high Sierra, from Shasta to Kern Counties and the northwest coast, primarily at lower and mid elevations	A variety of habitats from desert to coniferous forest but most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California and oak woodland, grassland, and desert scrub in southern California; relies heavily on trees for roosts
Townsend's big-eared bat *Corynorhinus townsendii pallescens*	–/SSC/–	Klamath Mountains, Cascades, Sierra Nevada, Central Valley, Transverse, and Peninsular Ranges, Great Basin, and the Mojave and Sonora Deserts	Requires caves, tunnels, buildings or other human-made structures for roosting; gleans insects from brush or trees and feeds along habitat edges
Hoary bat *Lasurius cinerius*	–/SSC/–	Throughout California from sea level to 13,200 feet	Primarily found in forested habitats but also found in riparian areas and in park and garden settings in urban areas; day roosts within foliage of trees
Western red bat *Lasiurus blossevillii*	–/SSC/WBWG: High priority	Scattered throughout much of California at lower elevations	Found primarily in riparian and wooded habitats but occurs at least seasonally in urban areas; day roosts in trees within the foliage; found in fruit orchards and sycamore riparian habitats in the Central Valley

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Riparian woodrat *Neotoma fuscipes riparia*	E/SSC/–	Historical distribution along the San Joaquin, Stanislaus, and Tuolumne Rivers and at Caswell State Park in San Joaquin, Stanislaus, and Merced Counties; presently limited to San Joaquin County at Caswell State Park and a possible second population near Vernalis	Riparian habitats with dense shrub cover, willow thickets, and oak overstory
Riparian brush rabbit *Sylvilagus bachmani riparius*	E/E/–	Limited to San Joaquin County at Caswell State Park, near the confluence of the Stanislaus and San Joaquin Rivers, and the Paradise Cut area on Union Pacific right-of-way lands	Native valley riparian habitats with large clumps of dense shrubs, low-growing vines, and some tall shrubs and trees
San Joaquin kit fox *Vulpes macrotis mutica*	E/T/–	Principally occurs in the San Joaquin Valley and adjacent open foothills to the west; recent records from 17 counties extending from Kern County north to Contra Costa County	Saltbush scrub and grassland habitats, and occasionally agricultural fields

[a] Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

C = candidate species for which U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded.

– = no listing.

State

E = listed as endangered under the California Endangered Species Act.

T = listed as threatened under the California Endangered Species Act.

FP = fully protected under the California Fish and Game Code.

SSC = species of special concern in California.

– = no listing.

Western Bat Working Group (WBWG)

Available: <http://www.wbwg.org/spp_matrix.html>.

High priority = species are imperiled or at high risk of imperilment.

Table 5.7-2c. Special-Status Wildlife Species with Potential to Occur in the Program Area – Tulare Lake Basin

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Invertebrates			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–/–	Streamside habitats below 3,000 feet throughout the Central Valley	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant
Amphibians			
California tiger salamander *Ambystoma californiense*	T/SSC/–	Central Valley, including the Sierra Nevada foothills, up to approximately 1,000 feet; and coastal region from Butte County south to northeastern San Luis Obispo County	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy
Kern Canyon slender salamander *Bratrachoseps simatus*	–/T/–	Restricted in range to the Kern River drainage in the southern Sierra at elevations ranging between 980 and 6,300 feet	Isolated colonies along streams, ridges, and canyons on moist, shaded, north-facing rocky slopes and shaded tributary canyons in oak and mixed pine-oak woodland; found beneath rocks and rotting logs
Foothill yellow-legged frog *Rana boylii*	–/SSC/–	In the Klamath, Cascade, North Coast, South Coast, Transverse, and Sierra Nevada Ranges up to approximately 6,000 feet	Creeks or rivers in woodland, forest, mixed chaparral, and wet meadow habitats with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby
Western spadefoot *Spea hammondii*	–/SSC/–	Sierra Nevada foothills, Central Valley, Coast Ranges, coastal counties in southern California	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands
Reptiles			
Silvery legless lizard *Anniella pulchra pulchra*	–/SSC/–	Along the Coast, Transverse, and Peninsular Ranges from Contra Costa to San Diego Counties, with spotty occurrences in the San Joaquin Valley	Habitats with loose soil for burrowing or thick duff or leaf litter; often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas
Western pond turtle *Emys marmorata*	–/SSC/–	From the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of the Sierra Nevada	Ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Birds			
Tricolored blackbird *Agelaius tricolor*	–/SSC/–	Permanent resident in the Central Valley from Butte to Kern Counties; breeds at scattered coastal locations from Marin County south to San Diego County and at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grain fields; habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony
Short-eared owl *Asio flammeus*	–/SSC/–	Permanent resident along the coast from Del Norte to Monterey Counties although very rare in summer north of San Francisco Bay, in the Sierra Nevada north of Nevada County, in the plains east of the Cascades, and in Mono County; small, isolated populations	Freshwater and salt marshes, lowland meadows, and irrigated alfalfa fields; needs dense tules or tall grass for nesting and daytime roosts
Long-eared owl *Asio otus*	–/SSC/–	Permanent resident east of the Cascade Range from Placer County north to the Oregon border, east of the Sierra Nevada from Alpine to Inyo Counties; scattered breeding populations along the coast and in southeastern California; winters throughout the Central Valley and southeastern California	Nests in abandoned crow, hawk, or magpie nests, usually in dense riparian stands of willows, cottonwoods, live oaks, or conifers
Western burrowing owl *Athene cunicularia hypugea*	–/SSC/–	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Level, open, dry, heavily grazed or low stature grassland or desert vegetation with available burrows
Redhead *Aythya Americana*	–/SSC/–	Permanent resident and winter migrant in the Central Valley and central California foothills	Usually nests in freshwater wetlands with tall emergent vegetation interspersed with areas of deep, open water; in winter and migration, forage and rest on large, deep bodies of water and may form rafts far from shore
Swainson's hawk *Buteo swainsoni*	–/T/–	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley; highest nesting densities occur near Davis and Woodland, Yolo County	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields
Western snowy plover (inland populations) *Charadrius alexandrinus nivosus* (nesting)	T/SSC/–	Nests at inland lakes throughout northeastern, central, and southern California, including Mono Lake and the Salton Sea	Barren to sparsely vegetated ground at alkaline or saline lakes, reservoirs, ponds, and riverine sand bars; also along sewage, salt-evaporation, and agricultural wastewater ponds

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Mountain plover *Charadrius montanus*	–/SSC/–	Does not breed in California; in winter, found in the Central Valley south of Yuba County; along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties; and in parts of Imperial, Riverside, Kern, and Los Angeles Counties	Open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grain fields
Black tern *Chlidonias niger*	–/SSC/–	Migrant and breeder in the northeastern plateau and portions of the Central Valley	Nests in dense wetland vegetation; uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields
Northern harrier *Circus cyaneus*	–/SSC	Throughout lowland California; has been recorded in fall at high elevations	Nests and forages in grasslands, meadows, marshes, and seasonal and agricultural wetlands
Fulvous whistling duck *Dendrocygna bicolor*	–/SSC/–	Mainly a summer resident and migrant in California range	Freshwater and coastal marshes, rice fields, and flooded tall-grass areas with adjacent uplands; feeds nocturnally on seeds of emergent vegetation; ground nester; nests built on dense floating or flooded emergent vegetation
White-tailed kite *Elanus leucurus*	–/FP/–	Lowland areas west of the Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging
Greater sandhill crane *Grus canadensis tabida*	–/T/–	Breeds in Siskiyou, Modoc, Lassen, Plumas, and Sierra Counties; winters in the Central Valley, southern Imperial County, Lake Havasu National Wildlife Refuge, and the Colorado River Indian Reserve	Summers in open terrain near shallow lakes or freshwater marshes; winters in plains and valleys near bodies of fresh water
Bald eagle *Haliaeetus leucocephalus*	–/E, FP/–	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin; reintroduced into the central coast; winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierra Nevada, and east of the Sierra Nevada south of Mono County	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
American white pelican *Pelecanus erythrorhynchos*	–/SSC/–	In large water bodies throughout the state	Year-round in California range; winters along coast and breeds only inland; breed in multi-species assemblages of colonial nesters along lakes; nests on ground on earthen, sandy, and rocky islands or (rarely) peninsulas and (locally) on floating tule-mat islands; forages in shallow inland waters, such as open areas in marshes and along lake or river edges; wintering and non-breeding feed in shallow coastal marine habitats
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	–/SSC/–	Locally numerous in the Klamath Basin, Modoc Plateau, Great Basin desert, and large mountain valleys in northeastern California and in the San Joaquin Valley; common breeders in the Colorado River Valley, the Salton Sink, and the western Mojave desert; scarce in the Sacramento Valley and along the southern coast in Los Angeles, Riverside, and San Bernardino Counties	Nests in marshes with tall emergent vegetation, such as tules or cattails, generally in open areas and edges over relatively deep water; breeding marshes often on edges of deep water bodies such as lakes, reservoirs, and or larger ponds
Mammals			
Pallid bat *Antrozous pallidus*	–/SSC/WBWG: High priority	Throughout California except in the high Sierra, from Shasta to Kern Counties and the northwest coast, primarily at lower and mid elevations	A variety of habitats from desert to coniferous forest but most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California and oak woodland, grassland, and desert scrub in southern California; relies heavily on trees for roosts
Townsend's big-eared bat *Corynorhinus townsendii pallescens*	–/SSC/–	Klamath Mountains, Cascades, Sierra Nevada, Central Valley, Transverse and Peninsular Ranges, Great Basin, and the Mojave and Sonora Deserts	Requires caves, tunnels, buildings or other human-made structures for roosting; gleans insects from brush or trees and feeds along habitat edges
Hoary bat *Lasurius cinerius*	–/SSC/–	Throughout California from sea level to 13,200 feet	Primarily found in forested habitats but also found in riparian areas and in park and garden settings in urban areas; day roosts within foliage of trees
Western red bat *Lasiurus blossevillii*	–/SSC/WBWG: High priority	Scattered throughout much of California at lower elevations	Primarily in riparian and wooded habitats but occurs at least seasonally in urban areas; day roosts in trees within the foliage; found in fruit orchards and sycamore riparian habitats in the Central Valley

Common and Scientific Names	Status[a] Federal/State/ Other	Geographic Distribution	Habitat Requirements
Buena Vista Lake shrew *Sorex ornatus relictus*	E/SSC/–	In the basin of the historical Buena Vista Lake	In marshlands and riparian areas; prefers moist soil and uses stumps, logs, and litter for cover
San Joaquin kit fox *Vulpes macrotis mutica*	E/T/–	Principally in the San Joaquin Valley and adjacent open foothills to the west; recent records from 17 counties, extending from Kern County north to Contra Costa County	Saltbush scrub and grassland habitats and occasionally agricultural fields

[a] Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

C = candidate species for which U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded.

– = no listing.

State

E = listed as endangered under the California Endangered Species Act.

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FP = fully protected under the California Fish and Game Code.

SSC = species of special concern in California.

– = no listing.

Western Bat Working Group (WBWG)

Available: <http://www.wbwg.org/spp_matrix.html>.

High priority = species are imperiled or at high risk of imperilment.

5.7.4 Effects of Existing Impaired Water Quality on Biological Resources

The majority of agricultural effects on surface water quality occur below the major storage reservoirs in the Central Valley. Details of agricultural impacts are discussed in Section 5.10. The general effects of agriculture include water column toxicity, sediment toxicity, detectable pesticides, nutrients, and salinity. Because groundwater is recharged by downward seepage of surface water and may also be discharged to surface water, contamination can occur between these water sources. Irrigation seepage can contaminate groundwater that underlies porous soils that are heavily fertilized or that receive pesticide applications. Constituents of concern in Central Valley groundwater that are related to agriculture include nutrients, insecticides and herbicides, salt, trace elements, organic carbon and disinfection byproduct precursors, and microorganisms. Sources of these constituents are discussed in Chapter 4.

Possible effects of the existing water quality on natural communities and special-status plant and wildlife species primarily would occur in areas with high salinity and/or pesticide levels. Some special-status plants are adapted to alkaline or saline soils.

5.7.5 Impacts

This analysis focuses on the effects of the regulatory program on vegetation and wildlife at a programmatic level, rather than on the specific effects of management practices used by various growers.

Assessment Methods

To identify existing environmental conditions and special-status plant and wildlife species that could be affected by the program alternatives, ICF biologists reviewed the existing information listed below:

- CNDDB records search of the counties that are under the jurisdiction of the Central Valley Water Board (the program area),
- *Inventory of Rare and Endangered Plants of California* (CNPS 2009), and
- Printed and online information.

The evaluation of impacts is supported by the information provided in the environmental setting and by the following assumptions:

- Under all program alternatives, when a constituent of concern is identified through monitoring, management practices would be used to reduce the level of that constituent in surface water or groundwater.
- If monitoring shows that a constituent is not of concern, management practices currently used to address that constituent may be reduced or discontinued.

- Under Alternatives 2 through 5, the use of groundwater management practices would increase and the use of any surface water management practice that harms groundwater would decrease (e.g., retention ponds in coarse soils that encourage waste percolation to groundwater basins).

The origin of regulatory authority (e.g., coalition groups versus individual growers) may affect funding sources, outreach, and enforcement, but management practice selection is ultimately dependent on crop type, physical setting, and economics (as described in the ECR). It is infeasible to determine and quantify the effect, if any, of changes in the lead entity as a result of the program alternatives on management practices used to prevent water quality impacts. Consequently, a qualitative assessment of potential effects of program alternatives on vegetation and wildlife was performed. The management practices proven to benefit water quality, as described in the ECR, were reviewed and analyzed to identify the potential impacts of management practices on vegetation and wildlife.

Significance Determinations

For this analysis, an impact pertaining to vegetation and wildlife was considered significant under CEQA if it would result in any of the following environmental effects, which are based on professional practice and State CEQA Guidelines Appendix G (14 CCR 15000 et seq.).

- A substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or the USFWS;
- A substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by DFG or the USFWS;
- Substantial interference with the movement of any native resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors; or impedance of the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources;
- Conflict with the provisions of an adopted HCP; natural community conservation plan; or other approved local, regional, or state HCP;
- Substantial reduction in the habitat of a fish or wildlife species;
- Causation of a fish or wildlife population to drop below self-sustaining levels;
- The threat of elimination of a plant or animal community;
- Substantial reduction in the number of, or restriction of the range of, a rare or endangered plant or animal; or
- Effects that are incrementally small but cumulatively considerable, meaning that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Alternative 1 involves continuation and full implementation of the existing program. Use of coalition groups as the lead monitoring entities would continue, and third-party entities and growers would implement management practices in response to identified water quality issues. Under this alternative, management practices would be implemented to reduce the levels of identified constituents of concern below the baseline conditions for surface water. It is assumed that continuation of the program would result in implementation of a greater number of surface water management practices than are present under baseline conditions, due to continued use of the program's monitoring feedback loops.

The changes in management practices are not dictated by the alternative and would vary widely, depending on choices made by individual growers for their crops, locations, and local and regional water quality concerns. Management practices expected to be implemented include nutrient management; improved water management; tailwater recovery systems; pressurized irrigation; sediment trap, hedgerow, or buffer zones; and cover cropping.

Use of nutrient management would positively affect both wildlife and vegetation, as it would limit the amount of nutrients going into waterways and would result in a net positive water quality impact over time. In addition, improved water management would benefit both wildlife and vegetation, as it would decrease the amount of sedimentation to surface water, which clogs the waterway and inhibits filter-feeding organisms along with chlorophyll organisms.

Tailwater recovery systems would result in beneficial impacts similar to those of improved water management, but there would be a lag time in release of the water because these systems perform like a detention pond, where sediment can settle and then the water is released back into the system or reused for irrigation. These management practices would result in a slight loss of water from evaporation and percolation, which could result in a very minimal amount of downstream riparian loss. This loss would be only during sediment settling time, and then the water would enter back into the system. Losses due to evaporation and percolation could be offset to an unknown degree if the recovered tailwater is reused for irrigation rather than discharged after settling. If the irrigation water comes from surface water diversions, reduced diversions would result in increased instream flows in the stream of origin. Thus, implementation of this management practice is not expected to result in significant effects. Sediment traps, hedgerows, or buffer zones would result in beneficial impacts similar to those of tailwater recovery systems in terms of the delay time for the water to capture sediment and the water eventually entering the system. Use of these management practices would result in a less-than-significant impact on wildlife and vegetation.

Use of runoff-reducing management practices would reduce surface water flows from fields, limiting the amount of water that returns to the waterway and resulting in a loss of habitat in areas adjacent to downstream waterways.

Impact BIO-1. Loss of Downstream Habitat from Reduced Field Runoff

Management practices that reduce field runoff would result in beneficial impacts on water quality but may adversely affect downstream wildlife and vegetation that depend on agricultural surface runoff. These practices cause water to be recirculated or used at an agronomic rate, resulting in a minimal amount of agricultural runoff. This would result in a net loss of water entering waterways and potential habitat loss along runoff ditches and downstream waterbodies.

Such habitat would be seasonally present, available only during times of irrigation, and unlikely to support sensitive communities or special-status plants. While reduced runoff leads to, or is the result of, reduced surface water diversions to fields, some regions rely largely on groundwater to irrigate. While it is anticipated that the loss of sensitive communities or special-status plants resulting from reduced runoff would be small, if any, data are insufficient to determine how much loss would occur. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-2** would reduce this impact to a less-than-significant level.

Impact BIO-2. Improved Water Quality in Natural Communities Adjacent to Agricultural Lands and Managed Wetlands

In general, the anticipated improvements in water quality as a result of program implementation under Alternative 1 would result in a beneficial effect on natural communities that receive runoff from agricultural lands or managed wetlands. Decreases in salinity and pesticide levels could benefit habitat quality for plant species, including special-status species, and sensitive natural communities located adjacent to managed wetlands. This would be a beneficial impact, and no mitigation is required.

Impact BIO-3. Potential Loss of Sensitive Natural Communities and Special-Status Plants from Construction Activities

Construction impacts would result from implementation of management practices that require physical changes, such as construction of water and sediment control basins, temporary water checks, tailwater return systems, vegetated drain systems, windbreaks, and filter strips. As stated above, it is difficult to determine to what extent management practices selected under Alternative 1 would change relative to existing conditions; thus, it is not possible to quantify any construction-related effects. However, it is logical to assume that continued implementation of Alternative 1 would result in selection of more management practices where testing reveals that water quality objectives are not being met. Consequently, implementation of Alternative 1 may result in effects on vegetation from construction activities.

In general, management practices would be implemented on existing agricultural lands and managed wetlands, which are unlikely to support native vegetation or special-status plants. However, construction that directly or indirectly affects natural vegetation communities adjacent to existing irrigated lands, particularly annual grasslands with inclusions of seasonal wetlands or vernal pools and riparian communities, could result in loss of sensitive wetland communities or special-status plants growing in the uncultivated or unmanaged areas. While it is anticipated that the loss of sensitive communities or special-status plants resulting from construction activities would be small, if any, data are insufficient to determine how much loss would occur. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-1** would reduce this impact to a less-than-significant level.

Alternative 2 – Third-Party Lead Entity

Monitoring, tracking, and management plan requirements of Alternative 2 are expected to result in changes similar to those in Alternative 1 in the use of management practices by growers, along with the addition of groundwater-specific practices. Under this alternative, management practices would be implemented to reduce the levels of identified constituents of concern below the baseline conditions for both surface water and groundwater. The reduction of identified constituents of concern below baseline levels is assumed to benefit sensitive natural communities as well as special-status plant and wildlife species. The changes in management practices are not dictated by the alternative and would vary widely, depending on choices made by individual growers for their crops, locations, and local and regional water quality concerns. Management practices expected to be implemented include nutrient management; improved water management; tailwater recovery systems; pressurized irrigation; sediment traps, hedgerows, or buffer zones; cover cropping; and wellhead protection.

Impact BIO-1. Loss of Downstream Habitat from Reduced Field Runoff

Impact BIO-1 is described under Alternative 1. This impact is considered less than significant with mitigation.

Impact BIO-2. Improved Water Quality in Natural Communities Adjacent to Agricultural Lands and Managed Wetlands

Impact BIO-2 is described under Alternative 1. This impact is considered beneficial.

Impact BIO-3. Potential Loss of Sensitive Natural Communities and Special-Status Plants from Construction Activities

Construction impacts would result from implementation of management practices that require physical changes, as described for Alternative 1. Under Alternative 2, it is assumed that management practices would be somewhat greater, with inclusion of groundwater-specific management practices such as wellhead protection. Consequently, implementation of Alternative 2 may result in effects on vegetation from construction activities.

While it is anticipated that the loss of sensitive communities or special-status plants resulting from construction activities would be small, if any, data are insufficient to determine how much loss would occur. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-1** would reduce this impact to a less-than-significant level.

Impact BIO-4. Potential Loss of Wetland Communities due to Loss of Existing Sedimentation Ponds

Under Alternative 2, the assumed decrease in the use of surface water management practices that are harmful to groundwater could result in abandonment or fill of tailwater sedimentation ponds in areas that currently percolate water to groundwater basins. Although they are artificially created features, sedimentation ponds can develop vegetation communities that support wetland species, depending on the specific hydrologic regime of individual ponds. Ponds that hold water intermittently or seasonally may support plant species adapted to seasonal wetland conditions, and ponds that are continually flooded may support emergent vegetation adapted to permanent wetland conditions. Thus, the loss of these ponds could result in drying of artificially created wetlands and an indirect loss of wetland habitat. The loss of wetland communities resulting from abandonment or fill of retention ponds would be small but cannot be quantified. It is also important to note that implementation of one of the potential management practices under this alternative, installation of tailwater return systems, would result in creation of tailwater ponds that could develop the same wetland characteristics as the abandoned or filled sedimentation ponds. Creation of new tailwater ponds could result in no net loss or potentially an increase in these wetland communities. However, the final extent of the tailwater ponds that could be created under this alternative cannot be quantified. Consequently, the loss of existing sedimentation ponds is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-2** would reduce this impact to a less-than-significant level.

Impact BIO-5. Impacts to Special-Status Wildlife Species due to Loss of Existing Sedimentation Ponds

Under Alternative 2, the assumed decrease in the use of surface water management practices that are harmful to groundwater could result in abandonment or fill of tailwater sedimentation ponds in areas that currently percolate water to groundwater basins. Although they are artificially created features, sedimentation ponds can provide habitat for special-status wildlife species. The banks of these ponds could support habitat for special-status burrowing wildlife species, including San Joaquin kit fox and burrowing owl. Ponds that hold water intermittently or seasonally may support special-status wildlife species adapted to seasonal wetland conditions, such as vernal pool fairy shrimp and vernal pool tadpole shrimp, California red-legged frog, and California tiger salamander, depending on the proximity of these ponds to natural habitats. The ponds also provide foraging habitat for many bird species. Ponds that hold water intermittently provide foraging habitat for wading birds, and ponds that are continually flooded may support foraging and nesting habitat for waterfowl. The abandonment or fill of retention ponds would be small and cannot be quantified but could affect wildlife species that are dependent on them. As discussed under **Impact BIO-4**, however, the creation of new tailwater ponds could mitigate part or all of this impact. Because the extent of new tailwater ponds cannot be quantified, the loss of existing sedimentation ponds is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-1** would reduce this impact to a less-than-significant level.

Alternative 3 – Individual Farm Water Quality Management Plans

Potential impacts related to vegetation and wildlife under Alternative 3 are expected to be as described for Alternative 2. Like Alternative 2, Alternative 3 would implement water quality management plans that would result in a beneficial impact on surface water quality and groundwater quality, which would ultimately benefit both vegetation and wildlife communities.

Alternative 4 – Direct Oversight with Regional Monitoring

Potential impacts related to vegetation and wildlife under Alternative 4 are expected to be as described for Alternative 2 and Alternative 3. Alternative 4 would additionally implement nutrient management plans that would result in a beneficial impact on surface water quality and groundwater quality, which would ultimately benefit both vegetation and wildlife communities.

Alternative 5 – Direct Oversight with Farm Monitoring

The potential changes in management practices under Alternative 5 would be similar to those described for Alternative 2. Alternative 5 would additionally implement nutrient management plans, which would ultimately benefit both vegetation and wildlife communities. Under Alternative 5, however, individual supply wells would be installed and monitored, which could result in direct impacts on land surface in agricultural lands and managed wetlands.

Impact BIO-6. Loss of Sensitive Natural Communities and Special-Status Plants from Construction Activities and Installation of Groundwater Monitoring Wells

Construction impacts would result from implementation of management practices that require physical changes and from installation of groundwater monitoring wells. As described for Alternative 2, it was assumed that Alternative 5 would result in the selection of more management practices than under existing conditions. The placement of monitoring wells cannot be predetermined; therefore, the potential impacts on sensitive natural communities and special-status plants cannot be quantified.

In general, management practices would be implemented on existing agricultural lands and managed wetlands, resulting in a less-than-significant impact. It was assumed that groundwater monitoring well placement also could be primarily limited to agricultural land and non-sensitive habitat. However, if construction related to implementation of management practices required changes to managed wetlands or to natural vegetation communities that are adjacent to existing irrigated lands, there would be a potential for loss of vegetation in sensitive wetland communities or loss of special-status plants growing in the uncultivated or unmanaged areas. While it is anticipated that the loss of sensitive communities or special-status plants resulting from construction activities would be small, if any, data are insufficient to determine how much loss would occur. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-1** would reduce this impact to a less-than-significant level.

Impact BIO-7. Loss of Special-Status Wildlife from Construction Activities and Installation of Groundwater Monitoring Wells

Construction impacts would result from implementation of management practices that require physical changes and from installation of groundwater monitoring wells. As described for Alternative 2, it was assumed that Alternative 5 would result in the selection of more management practices than under existing conditions. The placement of monitoring wells cannot be predetermined; therefore, the potential impacts on special-status wildlife species and their habitat cannot be quantified.

In general, management practices would be implemented on existing agricultural lands and managed wetlands, resulting in a less-than-significant impact. It was assumed that placement of groundwater monitoring wells also could be limited primarily to agricultural land and non-sensitive habitat. However, construction for management practices that require changes to managed wetlands or to natural vegetation communities adjacent to existing irrigated lands could result in a loss of special-status wildlife species occurring in the uncultivated or unmanaged areas. While it is anticipated that the loss of special-status wildlife species resulting from construction activities would be small, if any, data are insufficient to determine how much loss would occur. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure BIO-MM-1** would reduce this impact to a less-than-significant level.

5.7.6 Mitigation and Improvement Measures

Mitigation Measure BIO-MM-1: Avoid and Minimize Impacts on Sensitive Biological Resources

Implementation of the following avoidance and minimization measures would ensure that the construction activities related to implementation of management practices and installation of monitoring wells on irrigated lands would minimize effects on sensitive vegetation communities (such as riparian habitat and wetlands adjacent to the construction area) and special-status plants and wildlife species as defined and listed in Section 5.7.3. In each instance where particular management practices could result in impacts on the biological resources listed above, growers should use the least impactful effective management practice to avoid such impacts. Where the ILRP water quality improvement goals cannot be achieved without incurring potential impacts, individual farmers, coalitions, or third-party representatives should implement the following measures to reduce potential impacts to less-than-significant levels.

- Where detention basins are to be abandoned, retain the basin in its existing condition or ensure that sensitive biological resources are not present before modification.
- Where construction in areas that may contain sensitive biological resources cannot be avoided through the use of alternative management practices, conduct an assessment of habitat conditions and the potential for presence of sensitive vegetation communities or special-status plant and animal species prior to construction. this may include the hiring of a qualified biologist to identify riparian and other sensitive vegetation communities and/or habitat for special status plant and animal species;
- Avoid and minimize disturbance of riparian and other sensitive vegetation communities.
- Avoid and minimize disturbance to areas containing special-status plant or animal species.
- Where adverse effects on sensitive biological resources cannot be avoided, undertake additional CEQA review and develop a restoration or compensation plan to mitigate the loss of the resources.

Mitigation Measure BIO-MM-2: Determine Extent of Wetland Loss and Compensate for Permanent Loss of Wetlands

Prior to implementing any management practice that will result in the permanent loss of wetlands, conduct a delineation of affected wetland areas to determine the acreage of loss in accordance with current USACE methods. For compliance with the CWA Section 404 permit and WDRs, compensate for the permanent loss (fill) of wetlands and ensure no net loss of habitat functions and values. Compensation ratios will be determined through coordination with the Central Valley Water Board and USACE as part of the permitting process. Compensation may be a combination of mitigation bank credits and restoration/creation of habitat, as described below:

- Purchase credits for the affected wetland type (e.g., perennial marsh, seasonal wetland) at a locally approved mitigation bank and provide written evidence to the resource agencies that compensation has been established through the purchase of mitigation credits.
- Develop and ensure implementation of a wetland restoration plan that involves creating or enhancing the affected wetland type.

5.8.1 Introduction

This section discusses the regulatory framework for protection of fish resources, the environmental setting for fish within the program area, and the existing effects of impaired surface and groundwater on fish in the program area. The potential impacts on fish that may result from implementation of program alternatives are identified, and mitigation measures to avoid or reduce potentially significant impacts are presented.

5.8.2 Regulatory Framework

The following federal, state, and local policies and laws are relevant to fish in the program area. Some of these regulations are described in Section 5.7, Vegetation and Wildlife, as noted.

Federal

Endangered Species Act

The ESA protects fish species and their habitats identified by the USFWS and NMFS as threatened or endangered. *Endangered* refers to species, subspecies, evolutionarily significant units (ESUs), or distinct population segments (DPSs) that are in danger of extinction through all or a significant portion of their range[1]; *threatened* refers to species, subspecies, ESUs, or DPSs that are likely to become endangered in the near future. *Species of concern* refers to species, subspecies, ESUs, or DPSs that NMFS or USFWS are concerned about because of status and threats and for which there is insufficient information to warrant listing under the ESA. The ESA is administered by USFWS and NMFS. In general, NMFS is responsible for protection of ESA-listed marine species and anadromous fishes, whereas other listed species are under USFWS jurisdiction.

Section 7 – Endangered Species Act Consultation Process

Section 7 consultation is explained in Section 5.7, Vegetation and Wildlife.

Section 9 – Endangered Species Act Prohibitions

Section 9 of the ESA is explained in Section 5.7, Vegetation and Wildlife.

[1] An evolutionarily significant unit (ESU) is a population or group of populations that is substantially reproductively isolated from other population units of the same species and represents an important component in the evolutionary legacy of the species. *ESU* refers only to Pacific salmon species. A distinct population segment (DPS) is the smallest division of a taxonomic vertebrate species that is permitted to be protected under the Endangered Species Act. Individuals within a DPS may interbreed when mature but do not interbreed with individuals from other DPSs.

Sections 4(d) and 10 – Incidental Take

Incidental take is explained in Section 5.7, Vegetation and Wildlife.

Section 4(f) – Recovery Plans

As described in Section 5.7, Vegetation and Wildlife, Section 4(f) of the ESA requires that recovery plans be prepared for listed species. NMFS is currently developing a Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established a requirement to describe and identify essential fish habitat (EFH) in each fishery management plan. *EFH* is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (50 CFR 600.110). Important components of EFH are substrate; water quality; water quantity, depth, and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and habitat connectivity. The act requires all federal agencies to consult with NMFS on all actions or proposed actions that are permitted, funded, or undertaken by the agency that may adversely affect EFH. Only species managed under a federal fishery management plan are covered under EFH regulations. All four Central Valley Chinook salmon runs (winter-, spring-, fall-, and late fall–run Chinook salmon) are subject to the Magnuson-Stevens Act and are regulated by the Pacific Coast Salmon Fishery Management Plan (FMP). The FMP includes designation of EFH, which occurs within waters affected by the IRLP.

Sustainable Fisheries Act

The Sustainable Fisheries Act (Public Law 104-297) of 1996 reauthorized and amended the Magnuson Fishery Conservation and Management Act (now the Magnuson-Stevens Act), the latter of which was initially enacted in 1976 to define fisheries jurisdiction within federal waters and create the National Oceanic and Atmospheric Administration structure for federal fisheries management. The revisions provided in the 1996 law brought major changes to requirements for preventing overfishing and revitalizing depleted fisheries, mostly through the scientific management and reporting conducted via fisheries management reports.

Clean Water Act

Sections 401 and 404 of the CWA are described in Section 5.7, Vegetation and Wildlife. The responsibility of the State Water Board under Section 303(d) is described in Section 5.9, Hydrology and Water Quality.

Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA), requires EPA to regulate the sale and use of pesticides in the United States through registration and labeling of the pesticide products currently in use (EPA 2004). FIFRA directs EPA to restrict the use of pesticides as necessary to prevent unreasonable adverse effects on people and the environment, taking into account the costs and benefits of various pesticide uses. FIFRA prohibits sale of any pesticide in the

United States unless it is registered and labeled indicating approved uses and restrictions. Use of a pesticide in a manner that is inconsistent with the label instructions violates the law. In addition, FIFRA requires EPA to re-register older pesticides based on new data that meet current regulatory and scientific standards. EPA must ensure that the use of pesticides it registers under FIFRA will not result in harm to species listed as endangered or threatened under the ESA. USFWS and NMFS provide technical assistance and consult with EPA during the registration and re-registration of pesticides to prevent and minimize the impacts of pesticides on fish, wildlife, and plants. In addition, the EPA's Endangered Species Protection Program (ESPP) was initiated in 1988. This program relies on cooperation between USFWS, EPA regions, states, and pesticide users. As part of this program, EPA has created bulletins for individual counties within the United States that can be accessed from the ESPP website (http://www.epa.gov/espp/). The bulletins provide information on pesticide use limitations intended to minimize impacts on threatened and endangered species.

Recent Court Orders

Pesticide Buffer Zones around Salmonid Streams

A citizen suit was filed under the ESA against the EPA by a group of environmental organizations (*Washington Toxics Coalition et al. v. EPA*) who alleged that EPA violated Section 7(a)(2) of the ESA by failing to consult on the effects to 26 ESUs of listed Pacific salmonids from EPA's continuing approval of 54 pesticide active ingredients. On July 2, 2002, the Court ruled that EPA had violated ESA Section 7(a)(2) and ordered EPA to initiate interagency consultation with NMFS and make determinations about effects to the salmonids from all 54 active ingredients by December 2004. The court also issued an order on January 22, 2004, that establishes pesticide buffer zones. *Buffer zones* are areas adjacent to certain streams, rivers, lakes estuaries, and other water bodies, in which pesticides are not to be used. Generally, the buffers established by the Court are 20 yards for ground application and 100 yards for aerial application, adjacent to certain salmon-supporting waters in Washington, Oregon, and California. *Salmon-supporting waters* are defined as certain water bodies below the normal high water mark; buffers are measured from that normal high water mark. Waters included in the action are those supporting listed anadromous salmonids or their critical habitat. Failure to comply with the court order is not a violation of FIFRA. The court order remains in effect until one of the following occurs:

- EPA determines that these pesticides have no effect on listed Pacific salmon and steelhead,
- EPA determines that these pesticides are not likely to adversely affect these species, or
- EPA completes consultation with NMFS about the potential effects of the pesticides on Pacific salmon and steelhead.

NMFS will provide biological opinions on 37 active ingredients in pesticides by February 29, 2012, as a result of the court order against EPA registration (NMFS 2008a). The reasonable and prudent alternative included in the first of these biological opinions (NMFS 2008b, which deals with pesticides containing chlorpyrifos, diazinon, and malathion) includes specifications for enlarged buffer zones, restrictions on application in windy conditions or when soil is moist, provision of non-crop vegetation strips adjacent to cropland, reporting of fish kills following application, and monitoring of areas prone to pesticide runoff. The specific buffers to be applied under element 1 of the reasonable and prudent alternative are:

- Where ground applications are permitted: Do not apply pesticide products within 500 feet (152.4 meters) of salmonid habitats[2].
- Where aerial applications are permitted: Do not apply pesticide products within 1,000 feet (304.8 meters) of salmonid habitats.

It is estimated that the 500-foot and 1,000-foot buffers would translate into 820,000 and 1.34 million acres, respectively, of cultivated land within the range of listed salmonids in California's Central Valley, equivalent to 36 percent and 59 percent, respectively, of the total acreage (Poletika et al. 2009). EPA set a deadline of May 13, 2010, for pesticide registrants to confirm that they will comply with the limitations imposed by the NMFS (2008b) biological opinion or be subject to administrative procedures under FIFRA (Keigwin 2010).[3] A May 7 reply letter from the pesticide registrants stated that they would not be willing to make any of the registration revisions described by EPA in its previous letters to the registrants (EPA 2010).

San Francisco Bay Area Endangered Species Litigation

On May 30, 2007, the Center for Biological Diversity filed a lawsuit in the Federal District Court for the Northern District of California alleging that EPA failed to comply with Section 7(a)(2) of the ESA in regard to 74 pesticides that may affect 11 species that are listed as endangered or threatened under the ESA (*Center for Biological Diversity v. EPA*, Case No. 07-2794-JCS [N.D. Cal.]). The species identified in the lawsuit are found in the greater San Francisco Bay area: Alameda whipsnake, bay checkerspot butterfly, California clapper rail, California freshwater shrimp, California tiger salamander, delta smelt, salt marsh harvest mouse, San Francisco garter snake, San Joaquin kit fox, tidewater goby, and valley elderberry longhorn beetle. Comments are currently being solicited by EPA on a stipulated injunction and proposed order; the injunction would require EPA to make effects determinations and initiate consultation with USFWS under Section 7(a)(2) of the ESA for all 74 pesticides by the end of 2011. During the effects determination phase, the injunction would limit pesticide use (for example, by requiring application buffers), dependent on pesticide and species.

State

California Endangered Species Act

The CESA is described in Section 5.7, Vegetation and Wildlife.

California Environmental Quality Act

CEQA is described in Section 5.7, Vegetation and Wildlife.

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[2] *Salmonid habitats* is defined as freshwaters, estuarine habitats, and nearshore marine habitats including bays within the ESU/DPS range, including migratory corridors. The freshwater habitats include intermittent streams and other temporally connected habitats to salmonid-bearing waters. Freshwater habitats also include all known types of off-channel habitats as well as drainages, ditches, and other manmade conveyances to salmonid habitats that lack salmonid exclusion devices.

[3] In fact, the EPA (2009:5) letter to pesticide registrants notes "If the registrants are prepared to adopt some of these limitations, the Agency [EPA] will work with you to develop the terms and conditions of the amendment request and the process that will be followed to proceed with requesting these changes to product labeling."

California Fish and Game Code

Section 3515 – Fully Protected Species

As described in Section 5.7, Vegetation and Wildlife, the CFCG prohibits take of fully protected species (also see "Regulatory Classification of Special-Status Species" below). Section 3515 of the CFCG lists fully protected fish.

Local

County Endangered Species Pesticide Application Bulletins

DPR issues county bulletins that describe the distribution and occurrence of ESA-listed species and contain worksheets to assist users in applying pesticides in a manner that will reduce potential impacts to ESA-listed species. The bulletin scheme is voluntary rather than mandatory, and the guidelines are currently superseded by the Court-ordered buffers around salmonid streams (see above).

Regulatory Classification of Special-Status Species

Special-status species are here defined to include all species native to California that have been specifically identified by USFWS, NMFS or DFG as currently warranting some level of protection from human impacts. Some species may be identified as requiring monitoring to assess the potential need for protection in the future. The following terms are used by state and federal agencies to designate special-status species. The terms are ranked approximately from the most to the least protective designation.

- Fully Protected (FP): Species designated as fully protected under CFGC Section 3515. FP species may not be taken or possessed at any time, and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocating bird species for the protection of livestock.
- Federal Endangered (FE): Species designated as endangered under the ESA (described above). An FE species is one that is in danger of extinction throughout all or a significant portion of its range. Harm of any individual of an FE species is prohibited except with prior authorization from USFWS or NMFS (most ESA-listed species are within USFWS jurisdiction; but some partly marine species, including all Pacific salmon and steelhead, are regulated by NMFS).
- State Endangered (SE): Species designated as endangered under the CESA (described above). These include native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes—including loss of habitat, change in habitat, overexploitation, predation, competition, or disease (CESA Section 2062). Harm of any individual of an SE species is prohibited except under special circumstances that require prior authorization from DFG.
- Federal Threatened (FT): Species designated as threatened under the ESA (described above). An FT species is one that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. At the discretion of USFWS or NMFS, harm of any individual of an FT species may be prohibited or restricted.

- State Threatened (ST): Species designated as endangered under the CESA (described above). These include native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts (CESA Section 2067). Harm of any individual of an ST species is prohibited except under special circumstances that require prior authorization from DFG.
- State Candidate (SC): Species designated as candidates for listing under the CESA (described above). These are native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the Fish and Game Commission has formally noticed as being under review by DFG for addition to either the list of endangered species or the list of threatened species, or a species for which the Commission has published a notice of proposed regulation to add the species to either list (CESA Section 2068). Harm of any individual of an SC species is prohibited except under special circumstances that require prior authorization from DFG.
- Species of Special Concern (SSC): A species, subspecies, or distinct population of a vertebrate animal native to California that has been determined by DFG to warrant protection and management intended to reduce the need to give the species formal protection as an SE, ST or SC species. *Species of Special Concern* is an administrative designation and carries no formal legal status. However, Section 15380 of the State CEQA Guidelines clearly indicates that species of special concern should be included in an analysis of project impacts if they can be shown to meet the criteria of sensitivity outlined therein (Comrack et al. 2008).
- Federal Proposed (FP): Species that have been proposed by USFWS or NMFS for listing as endangered or threatened under the ESA. FP species must be evaluated in the Section 7 consultation for any federal action (described under "Section 7 –Endangered Species Act Consultation Process") and are normally evaluated in the NEPA review of any action that may affect the species.
- Federal Candidate (FC): Species that are candidates for listing as endangered or threatened under the ESA. Such species have not yet been proposed for listing. Consideration of FC species can assist environmental planning efforts by providing advance notice of potential listings, allowing resource managers to alleviate threats and thereby possibly remove the need to list species as endangered or threatened. Thus, FC species are normally evaluated in the NEPA review of any action that may affect the species.
- Federal Species of Concern (FSoC): *Species of Concern* are not defined or mentioned in the ESA, but some offices of both NMFS and USFWS use this term to describe special-status species that have not been designated under any of the formal federal status terms described above. Usually these are species for which the agency (NMFS or USFWS) has some concerns about status or threats, but for which data are insufficient to indicate that the species warrants treatment as a candidate for listing.
- Designated Critical Habitat and Recovery Plans: Many FE and FT species have designated critical habitat and/or approved recovery plans. Federal regulations prohibit actions that would destroy or adversely modify designated critical habitat. One reason for designation of critical habitat is that, although such habitat may not be currently occupied, it is essential in order to achieve recovery of these species. Accordingly, for these species, the species distribution is assumed to include the known range of the species plus any additional areas of designated critical habitat. Species recovery plans identify actions that are required in order to secure recovery of a species.

Special-status species within the program area included in the analysis of impacts were limited to those listed under the ESA or CESA and other species that DFG has designated as SSC. The impact analysis was based on overlapping of the species ranges with the program area, using records from the CNDDB and other relevant sources (Moyle 2002).

5.8.3 Environmental Setting

Waters in the ILRP Program Area

A general physiographic description of the program area is provided in Chapter 4. Additionally, Section 5.7, Vegetation and Wildlife, describes the habitats of agricultural lands and managed wetlands; the latter category includes seasonal wetlands and semi-permanent and permanent wetlands. In addition to some of these wetland habitats, waters receiving inputs from irrigated lands within the program area are of major importance to fish. The description below is largely based on the account of existing habitat by Williams (2006) and sources therein.

The Sacramento and San Joaquin Rivers run south and north, respectively, along the Central Valley and meet at the Delta, the upper portion of the San Francisco estuary where approximately 5 percent of historical tidal wetlands remain. South of the San Joaquin River is the Tulare Lake Basin, the rivers of which are not tributary to the other two main rivers in the Central Valley or the sea; therefore, native anadromous fishes are not present, but endemic inland fishes are. Rivers reaching into the Sierra Nevada are fed by both snow melt and rainfall (e.g., the Mokelumne) whereas lower rivers not extending into the mountains receive only rainfall (e.g., the Cosumnes). Most of the major rivers in the program area have been dammed for flood control, water storage, and hydroelectricity purposes, restricting habitat for migratory fish such as anadromous salmonids. Dams are generally found among the foothills of mountain ranges. Natural flow cycles are dammed, and water from reservoirs is released mostly during summer to allow irrigation and to prevent impaired water quality for farmlands receiving water from the Delta. Because floods occur primarily because of winter storms, water is gradually released before winter, with temporary increases following storms until early spring, when the reservoir levels are allowed to increase. The reservoirs then capture and store snow melt runoff for release later in the year.

Considerable quantities of water are exported from the Delta to supply water storage facilities and agriculture in the San Joaquin Valley and further south. Export flows alter flow patterns in the Delta and entrain fish at the export facilities. The Sacramento River and its tributaries rarely pose problems for fish migration because of reduced flows. This is not the case in the San Joaquin River, where sections of the river have been without water for more than half a century. The San Joaquin River Restoration Program began flow releases from Millerton Reservoir in late 2009 that are the first step in an attempt to restore Chinook salmon to that river. Major sections of Central Valley rivers have been separated from historical floodplains by levees constructed for flood control. Bypasses created by these actions may function as important habitat for species such as Chinook salmon when flooded (Sommer et al. 2001). Mitigation for lost salmonid habitat behind impassable dams is provided by five hatcheries (Coleman National Fish Hatchery on Battle Creek, Feather River Hatchery, Nimbus Hatchery, Mokelumne River Fish Hatchery, and Merced River Fish Facility) that together release 30 million juvenile salmon and approximately 1 million juvenile steelhead into rivers or the San Francisco Bay.

Special-Status Species

Thirty-one special-status fish species are in areas encompassed by the ILRP (Table 5.8-1). Life-stage occurrence and timing are presented in Table 5.8-2 for anadromous fish formally listed under the ESA or CESA that occur in the ILRP program area. An account for the fall-run/late fall–run Chinook salmon ESU is also presented because this ESU is subject to a federal FMP (making it subject to EFH requirements under the Magnuson-Stevens Act; see above) and includes the majority of Chinook salmon in the ILRP program area.

Table 5.8-1. Special-Status Fish Species Potentially Affected by the Irrigated Lands Regulatory Program

Common Name	Scientific Name	Federal Status	State Status
Lampreys			
Lamprey, river	*Lampetra ayresii*	–	SSC
Lamprey, Kern Brook	*Lampetra hubbsi*	–	SSC
Lamprey, Goose Lake	*Lampetra tridentata* ssp. 1	–	SSC
Anadromous Non-Salmonid Fish			
Sturgeon, green (Southern DPS)	*Acipenser medirostris*	FT	SSC
Smelt, delta	*Hypomesus transpacificus*	FT	ST
Smelt, longfin	*Spirinchus thaleichthys*	–	ST, SSC
Salmonid Fish			
Trout, Lahontan cutthroat (Western Lahontan Basin)	*Oncorhynchus clarkii henshawi*	FT	–
Trout, Paiute cutthroat	*Oncorhynchus clarkii seleniris*	FT	–
Trout, California golden	*Oncorhynchus mykiss aguabonita*	–	SSC
Trout, Kern River rainbow	*Oncorhynchus mykiss gilberti*	–	SSC
Steelhead (California Central Valley DPS)	*Oncorhynchus mykiss irideus*	FT	–
Trout, Goose Lake redband	*Oncorhynchus mykiss* ssp. 1	–	SSC
Trout, McCloud River redband	*Oncorhynchus mykiss* ssp. 2	–	SSC
Trout, Little Kern golden	*Oncorhynchus mykiss whitei*	FT	–
Salmon, chinook (Central Valley fall-/late fall–run ESU)	*Oncorhynchus tshawytscha*	FSoC	SSC
Salmon, chinook (Central Valley spring-run ESU)	*Oncorhynchus tshawytscha*	FT	ST
Salmon, chinook (Sacramento River winter-run ESU)	*Oncorhynchus tshawytscha*	FE	SE
Freshwater and Estuarine Fish			
Chub, Goose Lake tui	*Gila bicolor thalassina*	–	SSC
Chub, Lahontan Lake tui	*Gila bicolor pectinifer*	–	SSC
Hitch, Clear Lake	*Lavinia exilicauda chi*	–	SSC
Roach, pit	*Lavinia symmetricus mitrulus*	–	SSC
Roach, San Joaquin	*Lavinia symmetricus* ssp. 1	–	SSC
Roach, Red Hills	*Lavinia symmetricus* ssp. 3	–	SSC
Hardhead	*Mylopharodon conocephalus*	–	SSC

Common Name	Scientific Name	Federal Status	State Status
Splittail, Sacramento	*Pogonichthys macrolepidotus*	–	SSC
Sucker, Modoc	*Catostomus microps*	FE	SE, FP
Sucker, Goose Lake	*Catostomus occidentalis lacusanserinus*	–	SSC
Sucker, mountain	*Catostomus platyrhynchus*	–	SSC
Perch, Sacramento	*Archoplites interruptus*	–	SSC
Sculpin, rough	*Cottus asperrimus*	–	ST
Sculpin, bigeye marbled	*Cottus klamathensis macrops*	–	SSC

Notes:

FE = Federal endangered.

FP = DFG fully protected species.

FSoC = Federal species of concern.

FT = Federal threatened.

SE = State endangered.

SSC = DFG species of special concern.

ST = State threatened.

– = no listing.

Sources: Source for species names, table order, and listing status information is California Department of Fish and Game (2009a), except for some species names from Moyle (2002) and Moyle et al. (2008).

Table 5.8-2. Assumed Life Stage, Timing, and Distribution of Anadromous Listed Species Potentially Affected by the Irrigated Lands Regulatory Program

Species		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall–Run Chinook Salmon (Central Valley Fall-/Late Fall–Run Chinook Salmon Evolutionarily Significant Unit)													
Adult migration	SF Bay to Upper Sacramento River and tributaries, Mokelumne River, and SJR tributaries												
Spawning	Upper Sacramento River and tributaries, Mokelumne River, and SJR tributaries												
Egg incubation[a]	Upper Sacramento River and tributaries, Mokelumne River, and SJR tributaries												
Juvenile rearing (natal stream)	Upper Sacramento River and tributaries, Mokelumne River, and SJR tributaries												
Juvenile movement and rearing	Upper Sacramento River and tributaries, Mokelumne River, and SJR tributaries to SF Bay												
Late Fall–Run Chinook Salmon (Central Valley Fall-/Late Fall–Run Chinook Salmon Evolutionarily Significant Unit)													
Adult Migration and Holding	SF Bay to Upper Sacramento River and tributaries												
Spawning[a]	Upper Sacramento River and tributaries												
Egg incubation	Upper Sacramento River and tributaries												
Juvenile rearing (natal stream)	Upper Sacramento River and tributaries												
Juvenile movement	Upper Sacramento River and tributaries to SF Bay												
Central Valley Spring-Run Chinook Salmon Evolutionarily Significant Unit													
Adult migration and holding	SF Bay to Upper Sacramento River and tributaries												

	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning	Upper Sacramento River and tributaries												
Egg incubation	Upper Sacramento River and tributaries												
Juvenile rearing (natal stream)	Upper Sacramento River and tributaries												
Juvenile movement	Upper Sacramento River and tributaries to SF Bay												
Sacramento River Winter-Run Chinook Salmon Evolutionarily Significant Unit													
Adult migration and holding	SF Bay to Upper Sacramento River												
Spawning	Upper Sacramento River												
Egg incubation	Upper Sacramento River												
Juvenile rearing (natal stream)	Upper Sacramento River to SF Bay												
Juvenile movement and rearing	Upper Sacramento River to SF Bay												
California Central Valley Steelhead Distinct Population Segment													
Adult migration	SF Bay to Upper Sacramento River and tributaries												
Spawning	Upper Sacramento River and tributaries												
Egg incubation	Upper Sacramento River and tributaries												
Juvenile rearing	Upper Sacramento River and tributaries to SF Bay												
Juvenile movement	Upper Sacramento River and tributaries to SF Bay												

Species		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Delta Smelt													
Adult migration	Delta												
Spawning	Delta, Suisun Marsh												
Larval and early juvenile rearing	Delta, Suisun Marsh												
Estuarine rearing: juveniles and adults	Lower Delta, Suisun Bay												
Longfin Smelt													
Adult migration	SF Bay and San Pablo Bay to Suisun Bay, Suisun Marsh, Delta, Lower Sacramento River and Lower San Joaquin River												
Spawning	Suisun Marsh, Lower Sacramento and San Joaquin Rivers												
Larval and early juvenile rearing and movement	Suisun Bay, San Pablo Bay, Lower Delta												
Adult and juvenile rearing	SF Bay, Suisun Bay, San Pablo Bay												
Green Sturgeon													
Adult migration and holding	SF Bay to upper Sacramento River												
Spawning	Upper Sacramento River												
Larval rearing	Upper Sacramento River												
Juvenile rearing and migration	Sacramento River, Delta, Suisun Bay												

Delta = Sacramento–San Joaquin River Delta; SF Bay = San Francisco Bay; SJR = San Joaquin River.

Note: Shading intensity indicates relative occurrence of life stages by month.

[a] Spawning and incubation occurs from October to February in the Feather, American, and Mokelumne Rivers.

Sources: Brown and Moyle 1993; Wang and Brown 1993; USFWS 1996; McEwan 2001; Moyle 2002; Hallock 1989; NMFS 2009; Williams 2006.

Green Sturgeon (Southern DPS)

Two DPSs exist for the green sturgeon: the southern DPS and the northern-Pacific DPS (68 FR 4433). The southern DPS includes the spawning populations of green sturgeon south of the Eel River (exclusive), principally including the Sacramento River green sturgeon spawning population. The northern-Pacific DPS includes spawning populations in the Eel, Mad, Trinity, and Klamath Rivers plus several coastal streams in Oregon.

Green sturgeon use both freshwater and saltwater habitat. As adults, green sturgeon live most of their lives in nearshore oceanic waters, bays, and estuaries. Mature adult green sturgeon move into large, turbulent freshwater rivers to spawn (Moyle et al. 1992a in Moyle 2002). Spawning occurs once the fish are more than 15 years old and is then believed to occur every 2 to 5 years (Moyle 2002). Green sturgeon migrate to fresh water in late February and spawn from March to July, with peak spawning occurring from April to June (Moyle et al. 1995). Each female produces from 60,000 to 140,000 eggs (Moyle 2002). Specific spawning habitat preferences are unclear, but eggs likely are broadcast over bedrock or sand to cobble substrates (Moyle et al. 1995). Juvenile green sturgeon live in fresh and estuarine waters for 1 to 3 years before out-migrating to salt water (Nakamoto et al. 1995 in NMFS 2009; Moyle 2002).

Juveniles and adults are benthic feeders, generally living close to the bottom of the water column, and juveniles have been reported to eat mysid shrimp and amphipods in the Delta (Radtke 1966 in Moyle 2002). Adults may eat small fish and macroinvertebrates (Moyle 2002).

Data for assessment of population abundance trends of the green sturgeon southern DPS are limited, and the generally low abundances and high interannual variability hinder trend detection. Nevertheless, the trend in number of juveniles appears to be downward based on collection of fish in rotary screw traps at Red Bluff Diversion Dam (RBDD) and the Glenn-Colusa Irrigation District (GCID) diversion dam, as well as from the density of fish salvaged (green sturgeon per volume of water exported) at the SWP and CVP fish facilities (NMFS 2009: 121–123). The main factor believed responsible for decline of the southern DPS green sturgeon is the reduction in spawning habitat to a limited section of the Sacramento River. There are numerous other threats, including insufficient freshwater flow rates at spawning areas, contaminants, entrainment, impassable barriers, influence of exotic species, small population size, elevated water temperatures, and by-catch of green sturgeon in fisheries, that could potentially affect the status of the southern DPS green sturgeon (Biological Review Team 2005; 71 FR 17757).

Delta Smelt

The delta smelt is listed under both the ESA and CESA as a threatened species (58 FR 12854, March 5, 1993). Rearing habitat for juvenile and adult delta smelt typically is found in the estuarine waters of the lower Delta and Suisun Bay, where salinity is between 2 and 7 parts per thousand (ppt). Delta smelt tolerate from 0 to 19 ppt salinity. Delta smelt occupy open shallow waters but also occur in the main channel in the region where fresh water and brackish water mix. They occur in the water column at depths of 0–4 meters (Kimmerer 2008:12). The mixing zone of fresh and brackish water may be hydraulically conducive to their ability to maintain position and metabolic efficiency (Moyle 2002).

Adult delta smelt begin a spawning migration, which may encompass several months, and move into the upper Delta during December or January. Spawning occurs between January and July, with peak spawning during April through mid-May (Moyle 2002). Spawning occurs in shallow edgewaters in the upper Delta channels, including the Sacramento River above Rio Vista, Cache Slough, Lindsey Slough, and Barker Slough. Spawning also was observed in the Sacramento River up to Garcia Bend during drought conditions, possibly attributable to adults moving farther inland in response to saltwater intrusion (Wang and Brown 1993). Most delta smelt spawn once and then die, although some individuals may spawn again (Bennett 2005:16). A small proportion of adults may survive a second year and spawn a year later. This may be important to the overall population because, although 2-year-olds are rare, female fecundity is much greater in older, larger individuals. A 70-millimeter (mm) female produces about 2,000 eggs whereas a 105-mm female produces about 7,000 eggs (Bennett 2005:16). Eggs are broadcast over the bottom, where they attach to firm sediment, woody material, and vegetation. Hatching takes approximately 9 to 13 days, and larvae begin feeding 4 to 5 days later. Newly hatched larvae contain a large oil globule that makes them semi-buoyant and allows them to stay off the bottom. Larval smelt feed on rotifers and other zooplankton. As their fins and swim bladder develop, they move higher into the water column. Larvae and juveniles gradually move downstream toward rearing habitat in the estuarine mixing zone (Wang 1986). Adult copepods are important as food for juvenile delta smelt. The copepod *Eurytemora affinis* and the mysid *Neomysis mercedis* were historically important prey for delta smelt (Moyle et al. 1992b:70) but have been largely replaced by the introduced copepod *Pseudodiaptomos forbesi* during summer months in the Delta (USFWS 2008a:228). Recent studies have suggested that a proportion of the delta smelt population exhibits a contingent life-history pattern. Instead of undergoing the migrations typical of the species, there is evidence that delta smelt may reside year-round in areas such as the Cache Slough Complex off the southern Sacramento River (Sommer et al. 2009:11–12).

From 1969 to 1981, the mean delta smelt Townet Survey (TNS) and Fall Midwater Trawl (FMWT) indices were 22.5 and 894, respectively. Both indices suggest that the delta smelt population declined abruptly in the early 1980s (Moyle et al. 1992b). From 1982 to 1992, the mean delta smelt TNS and FMWT indices dropped to 3.2 and 272 respectively. The population rebounded somewhat in the mid-1990s (Sweetnam 1999); the mean TNS and FMWT indices were 7.1 and 529, respectively, during the 1993–2002 period. However, delta smelt numbers have trended precipitously downward since about 2000 (USFWS 2008a).

Currently, the delta smelt population indices are two orders of magnitude smaller than historical highs, and recent population abundance estimates are up to three orders of magnitude below historical highs (Newman 2008). The median TNS index from 2000 through 2008 fell similarly to 1.6; and it has dropped to its lowest levels during the last 4 years, with indices of 0.3, 0.4, 0.4, and 0.6 during 2005 through 2008, respectively. It is highly unlikely that the indices from 2004 to 2007 can be considered statistically different from one another (Sommer et al. 2007), but they are very likely lower than at any time prior in the period of record. The total number of delta smelt collected in the 20-mm survey decreased substantially during the years from 2002 to 2008 (from 4,917 to 587 fish) compared with the period from 1995 through 2001 (from 98 to 1,084 fish) (USFWS 2008).

Severe alterations in the composition and abundance of the primary producer and primary/secondary consumer assemblages[4] in the Delta have been implicated in the recent decline of delta smelt and other native fish species (USFWS 1996; Kimmerer 2002). The decrease in abundance of

[4] Primary consumers may be zooplankton, fish, or other aquatic organisms that feed on primary producers (phytoplankton); secondary consumers (including fish and other organisms) feed on primary consumers.

various pelagic (open-water) fish species has been termed the Pelagic Organism Decline (POD) and is currently under investigation (Sommer et al. 2007). Factors that may have contributed to the POD phenomenon include reductions in food quantity (e.g., non-native invertebrate consumption of phytoplankton leading to reduced zooplankton prey for small pelagic fishes), reductions in population size (through losses at water diversions or to non-native predators), and detrimental changes to habitat (e.g., increases in contaminants and other chemical constituents, as well as alterations of salinity, temperature, and turbidity regimes) (Sommer et al. 2007). The delta smelt exhibits an unusual life-history compared to most fishes, which may make it susceptible to environmental alterations. It has a very limited range (portions of the San Francisco estuary), generally lives for only 1 year, and has relatively low fecundity.

Longfin Smelt

The longfin smelt is found from Alaska to California. In California, varying sizes of populations of longfin smelt are found in the lower portions of the major watersheds (Klamath River, Eel River, and Russian River) (DFG 2009b:5–6). The largest population is likely to be that inhabiting the San Francisco estuary, including the Delta. Wang (1986:6–10) found a single longfin smelt at Moss Landing in Monterey Bay. In the San Francisco estuary, the longfin smelt is rarely found upstream of Rio Vista or Medford Island in the Delta (Moyle 2002:236), although in low-flow years, longfin smelt may occur almost as far upstream as the City of Sacramento on the Sacramento River and to Rough-and-Ready Island on the San Joaquin River (DFG 2009b:7). Adults concentrate in Suisun, San Pablo, and North San Francisco Bays (Moyle 2002). Off-channel, upstream areas such as the Cache Slough Complex and the Yolo Bypass also may be occupied (DFG 2009b:7).

Longfin smelt are anadromous and pelagic; adults occupy the upper portion of the water column and juveniles, the middle to bottom (Wang 1986:6–10, Moyle 2002:236). Adults and juveniles are found in estuaries and can tolerate salinities from 0 ppt to full-strength sea water. Most larval and early-juvenile longfin smelt are found in salinities ranging from 1.1 to 18.5 ppt (Unger 1994:7). After the early juvenile stage, salinities in the 15-to 30-ppt range are generally occupied (Moyle 2002:236). Longfin smelt in the San Francisco estuary spawn in fresh or slightly brackish water (Moyle 2002:236). Prior to spawning, these fish aggregate in deepwater habitats available in the northern Delta, including primarily the channel habitats of Suisun Bay and the Sacramento River (Rosenfield and Baxter 2007). Catches of gravid (carrying eggs internally) adults and larval longfin smelt indicate that the primary spawning locations for these fish are in or near the Suisun Bay channel, the Sacramento River channel near Rio Vista, and (at least historically) Suisun Marsh (Wang 1991; Moyle 2002; Rosenfield and Baxter 2007). Moyle (2002) indicated that longfin smelt may spawn in the San Joaquin River as far upstream as Medford Island. In the Delta, longfin smelt spend most of their life cycle in deep, cold, brackish-to-marine waters of the Delta and nearshore environments (Moyle 2002; Rosenfield and Baxter 2007). They are capable of living their entire life cycle in fresh water, as demonstrated by landlocked populations.

Prespawning adults are generally restricted to brackish (2–35 ppt) or marine habitats. In fall and winter, longfin smelt move upstream into fresh water to spawn. Most spawners are 2 years old, with lesser numbers of 1- and 3-year-olds (DFG 2009b:10). Spawning may occur as early as November, and larval surveys indicate that spawning may extend into June (Moyle 2002). The exact nature and extent of spawning habitat are still unknown for this species (Moyle 2002), although major aggregations of gravid adults occur in the northwestern Delta and eastern Suisun Bay (Rosenfield and Baxter 2007). Fecundity ranges from approximately 1,900 eggs in a 73-mm female to approximately 18,000 eggs in a 120-mm female (DFG 2009b:11).

Embryos hatch in 40 days at 7 degrees Celsius (°C) and are buoyant (Dryfoos 1965, as cited by Moyle 2002:236). They move into the upper part of the water column and are carried into the estuary. High outflows transport the larvae into Suisun and San Pablo Bays. In low outflow years, larvae move into the western Delta and Suisun Bay. Higher outflows are reflected positively in juvenile survival and adult abundance. Rearing habitat is highly suitable in Suisun and San Pablo Bays, in part because juveniles require brackish water in the 2- to 18-ppt range. Longfin smelt are pelagic foragers that feed extensively on copepods, amphipods, and shrimp (USFWS 1996; Moyle 2002).

Year-class abundance of longfin smelt appears to depend, in part, on the environmental conditions experienced by the eggs and young fish. One such factor is Delta inflow and outflow during larval and early juvenile life stages. Outflow affects the downstream distribution of smelt and their vulnerability to entrainment in diversions. Both inflows and outflows move larvae and juveniles into the low-salinity zone, where feeding conditions are optimal (Kimmerer 2002). Freshwater flows during the late winter and early spring clearly are related to increased production of young-of-the year (YOY) longfin smelt (Stevens and Miller 1983; Jassby et al. 1995; Meng and Matern 2001; Kimmerer 2002; Rosenfeld and Baxter 2007). Moyle (2002) attributed the relationship between smelt abundance and outflow to reduced availability of brackish water habitat for larvae and juveniles. Baxter (2000, in Moyle 2002) found that smelt numbers are a function of the number of spawners and of outflow during spawning and larval periods in the previous year. Herbold (1998 pers. comm. to Moyle 2002:237) developed a regression indicating that mean spring (March–May) outflows much less than 3,400 cubic feet per second (cfs) would cause reproductive failure. Outflow in the years 1986–1994 (including the 1987–1992 drought) was close to this level. Although not highlighted by these authors, relationships with Delta outflow also would hold true for Delta inflow because of the correlation between inflow and outflow.

Kimmerer (2002) found a negative relationship between abundance and X2[5], indicating higher abundance at higher flows. This was the strongest fish-X2 relationship found, although it declined by a factor of 4 after 1987 (Kimmerer 2002:46) and establishment of the Asian Corbula clam. Dege and Brown (2004) found a strong relationship between X2 and the distribution of longfin smelt: although the geographic distribution of YOY longfin varied over the years 1995–2001, annual distributions always were centered on the location of X2. As mentioned for delta smelt, Dege and Brown's (2004) findings are consistent with the hypothesis that abundance is controlled in part by an X2 location affording maximum rearing habitat. However, a recent examination by Kimmerer et al. (2009) indicated that "the mechanism chiefly responsible for the X2 relationship for longfin smelt remains unknown." This was because changes in habitat availability (defined by salinity) were insufficient to support observed changes in abundance. Kimmerer et al. (2009) suggested that the mechanism may be related to juvenile longfin smelt increasing the probability of their retention within preferred waters by occupying deeper waters under higher salinity conditions.

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[5] *X2* is the location in the San Francisco Bay-Delta estuary relative to the Golden Gate Bridge (measured in kilometers) of the 2-parts per thousand (ppt) isohaline 1 meter off the bottom (San Francisco Estuary Project 1993). An *isohaline* is a line connecting all points of equal salinity. X2 represents the upstream end of the entrapment zone (where riverine current meets upstream-flowing estuarine currents and variations in flow interact with particle settling to trap particles, resulting in a region of the estuary characterized by higher levels of particulates, higher abundance of several types of organisms, and a turbidity maximum—and the transition from fresh water to the estuarine salt gradient). X2 is a function of Delta outflow volume; as outflow increases, X2 is reduced (the 2-ppt isohaline moves downstream).

Moyle (2002) speculated that the continuing decline of longfin smelt abundance is attributable to multiple factors acting synergistically. Besides outflow/X2, Moyle identified entrainment (SWP, CVP, and in-Delta agricultural) and take during salvage, the impact of introduced species on longfin food supply, extreme flooding during spawning, impacts of introduced predators, and toxic substances as possible contributors. In its petition for the listing of longfin smelt under the ESA, the Bay Institute (2007) also cited outflow, entrainment, food-related impacts of invasive species, and toxic pollutants as probable contributors to the decline of longfin abundance. They did not list predation by invasive species or flooding but did include increase in water temperature and physical disruption of spawning habitat and critical prey species habitat by dredging.

The abundance of longfin smelt in the San Francisco estuary has fluctuated over time. However, abundance has been in decline since the early 1980s and was very low during the drought years of the 1990s and in recent wet years (Rosenfield and Baxter 2007; Sommer et al. 2007). The decline has been seen in the reduction of longfin smelt captured in the percent of trawls throughout San Francisco Bay (Rosenfield and Baxter 2007). The 2007 FMWT had the lowest index (13) recorded since the survey began in 1967. The highest index between 1988 and 2008 was 8,205 (in 1995). The index in 2008 was 139 (DFG 2009c).

Severe alterations in the composition and abundance of the primary producer and primary/secondary consumer assemblages in the Delta have been implicated in the recent decline of longfin smelt and other native fish species (USFWS 1996; Kimmerer 2002). In combination with other factors, these alterations have resulted in longfin smelt being listed as threatened under the CESA in early 2009. The California Fish and Game Commission (2009:1) stated:

> In making the recommendation to list the longfin smelt pursuant to the California Endangered Species Act, the Department relied most heavily on the following: (1) longfin smelt is short-lived, (2) introductions of exotic organisms have altered its habitat, distribution, food supply, and possibly abundance, (3) water projects have adversely modified its habitat, distribution, food supply, and probably abundance, and (4) contaminants identified in ambient water samples have periodically adversely affected test organisms and may be affecting longfin smelt abundance. Threats to the longfin smelt population are likely to continue or increase, and several measures of longfin smelt abundance were examined and the Department found that they all indicate that the population has declined substantially.

Lahontan Cutthroat Trout (Western Lahontan Basin DPS)

The Lahontan cutthroat trout is native to the greater Lahontan Basin in eastern California, southern Oregon, and northern Nevada (Trotter 2008, cited by Moyle et al. 2008:247). In the Carson, Walker, and Truckee Basins, only a few scattered streams contain the western Lahontan Basin DPS of Lahontan cutthroat trout (Trotter 2008, cited by Moyle et al. 2008:247). The Lahontan cutthroat trout also has been planted and established in a few creeks outside its historical range, including west-slope drainages near the Truckee Basin (Moyle et al. 2008:247).

The Lahontan cutthroat trout occurs in a wide variety of coldwater river and lake habitats, including alkaline (e.g., Pyramid and Walker Lakes) and alpine oligotrophic lakes (e.g., Lake Tahoe and Independence Lake) (USFWS 1995:19). The Lahontan cutthroat trout primarily occupies streams with well-vegetated and stable stream banks and pools with cover nearby, as well as riffle-run complexes for spawning and cover (USFWS 1995:19). Lake residents are adapted to a wide variety of lake habitats with optimal average mid-summer epilimnion (the top-most layer in a thermally stratified lake) temperatures of less than 22°C and a mid-epilimnion pH of 6.5 to 8.5 (Moyle et al. 2008:246). The Lahontan cutthroat trout can tolerate alkalinity and total dissolved solid (TDS) levels as high as 3,000 milligrams per liter (mg/l) and 10,000 mg/l, respectively (Koch et al. 1979, cited by USFWS 1995:20).

Irrespective of occupation of rivers or lakes, the Lahontan cutthroat trout spawns in river habitats from April to July, depending on stream flow, water temperature, and elevation (USFWS 1995:20–21). Spawning migrations are observed at water temperatures between 5 and 16°C (Lea 1968, USFWS 1977, Sigler et al. 1983, Cowan 1983, all cited by USFWS 1995:21). Preferred water depths for redds (nests the females dig in the gravel for egg deposition) average 13 centimeters (cm), and velocities average 56 centimeters/ second (cm/s) (Schmetterling 2000, cited by Moyle et al. 2008:246), while gravel substrate ranges from 6 to 50 mm (Coffin 1981, cited by Moyle et al. 2008:246). Water must be saturated with oxygen and have minimal siltation to prevent eggs from suffocating. Eggs hatch after 4–6 weeks, depending on water temperature, and fry emerge from the gravel after 13–23 days (Calhoun 1942, Lea 1968, and Rankel 1976, all cited by USWFS 1995:21). Fry can spend up to 2 years in their natal stream before migrating to lake environments, but most migrate at the end of their first summer (Trotter 2008, cited by Moyle et al. 2008:246). Females reach reproductive maturity at 3–4 years, while males mature at 2–3 years. Consecutive-year spawning is unusual, and only 50 percent of surviving females and 25 percent of spawning males spawn again (Cowan 1982, cited by USFWS 1995:20). The Lahontan cutthroat trout generally lives for 4–9 years; stream-dwelling fish have shorter life spans than lake dwellers (Moyle et al. 2008:245). Stream-dwelling Lahontan cutthroat trout are opportunistic and feed mostly on drifting terrestrial and aquatic insects (Moyle 2002:290). Large Lahontan cutthroat trout also feed on juvenile fish of other species (Moyle et al. 2008:245).

Factors affecting Lahontan cutthroat trout abundance and habitat are the introduction of non-native trout, overexploitation, logging, dams and diversions, grazing, mining, loss of genetic diversity, and disease (Moyle et al. 2008:249–251). Moyle et al. (2008:249) estimated that probably only a few hundred wild self-sustaining fish age 1 year and older exist today. A recovery plan was adopted by USFWS in 1995 with the goal of improving the species' status sufficiently to warrant delisting. A number of actions included in this plan fall under the general headings of (1) permanent and temporary fish barriers, followed by non-native trout eradication and then repatriation of the Lahontan cutthroat trout; (2) construction of permanent barriers to protect Lahontan cutthroat trout-occupied upstream habitat; (3) eradication/control of non-native salmonids through electrofishing; and (4) barrier removal projects to reconnect habitat (USFWS 2009:44). Although there has been progress in some of these actions, the problems of interactions with non-native trout and habitat degradation remain to the extent that a change in listing is not warranted and some reconsideration of recovery plan actions should be considered (USFWS 2009:75–76).

Paiute Cutthroat Trout

The Paiute cutthroat trout is very similar to the Lahontan cutthroat trout but almost completely lacks spots and has different coloration (Moyle 2002:288; Moyle et al. 2008:254). It is native to only around 15 kilometers (km) of the Silver King Creek drainage in Alpine County but has been introduced to five other locations within the same drainage and seven other locations in Mono, Inyo, Tuolumne, Fresno, and Madera Counties (Moyle et al. 2008:256). The species has been extirpated from its historical range by introductions of trout from other sources and persists in around 33 km of stream habitat into which it was introduced (USFWS 2008b:4).

The Paiute cutthroat trout matures at 2 years of age and lives to only 3 or 4 years old (Wong 1975; USFWS 2004:11). Peak spawning is in June and July (Wong 1975). Eggs hatch after 6–8 weeks, and the fry emerge from the gravel 2–3 weeks later (USFWS 2004:11). Small juveniles (less than 50 mm long) occupy backwaters or mainstem shoal habitats (USFWS 2004:11). Moyle et al. (2008:255) note that the habitat requirements of the Paiute cutthroat trout appear to be similar to those of other alpine stream trout: cold (below 18–20°C), well oxygenated water; cover in the form of emergent vegetation and undercut banks; clean spawning gravel; and adequate food (invertebrates).

The Paiute cutthroat trout faces threats common to native trout within California. Other species of trout have been introduced to its native drainage, resulting in extirpation of the Paiute cutthroat trout by competition, predation, and hybridization (Moyle et al. 2008:257). Habitat loss due to grazing and recreational use caused declines in abundance (USFWS 2004:41–42). The species is made up of several small, isolated populations and is therefore vulnerable to large disturbances such as fires (USFWS 2004:45).

A recovery plan for the Paiute cutthroat trout was written by USFWS (2004). Its main element is the reintroduction of the species to its full native range after removing non-native trout. Abundance seems to be stable at around 1,000 fish (Moyle et al. 2008:256–257) Other conservation actions have included reductions in grazing and fishing within the Paiute cutthroat trout's range (USFWS 2004:9, 12).

California Central Valley Steelhead DPS

The California Central Valley steelhead DPS includes all naturally spawned anadromous steelhead below natural and man-made impassable barriers in the Sacramento and San Joaquin Rivers and their tributaries, excluding steelhead from San Francisco and San Pablo Bays and their tributaries but including two artificial propagation programs: the Coleman National Fish Hatchery, and the Feather River Hatchery.

The habitat requirements of Central Valley steelhead are similar to those of central California coast steelhead. Water quality is a critical factor during the freshwater residence time with cool, clear, and well-oxygenated water needed for maximum survival (Moyle 2002). Juvenile steelhead (ages 1+ and 2+) occupy deeper water than fry and show a stronger preference for pool habitats with ample cover, as well as for rapids and cascade habitats (Dambacher 1991). Juveniles generally occupy habitat with large structures such as boulders, undercut banks, and large woody debris that provide feeding opportunities, segregation of territories, refuge from high water velocities, and cover from fish and bird predators (Moyle et al. 2008).

Central Valley steelhead exhibit flexible reproductive strategies that allow for persistence in spite of variable flow conditions (McEwan 2001). Peak adult migration historically occurred from late September to late October, with some creeks—such as Mill Creek—showing a small mid-February run (Hallock 1989). Optimal spawning temperatures are from 4 to 11˚C (McEwan and Jackson 1996). Emergent fry migrate into shallow water (<36 cm) areas such as the stream edge or low gradient riffles, often in open areas with coarse substrates (Everest and Chapman 1972, Everest et al. 1986, and Fontaine 1988, all cited by Moyle et al. 2008). In the late summer and fall, juveniles move into higher velocity, deeper, mid-channel areas (Everest and Chapman 1972, Fontaine 1988, and Hartman 1965, all in Moyle et al. 2008). Age data from a sample of 100 fish taken in 1954 indicated that steelhead spent 1 (29 percent), 2 (70 percent), or 3 (1 percent) years in fresh water before migrating out of the basin to the ocean (Hallock et al. 1961). Juvenile Central Valley steelhead generally migrate from late December through the beginning of May, with a peak in mid-March (Moyle et al. 2008).

Central Valley steelhead are opportunistic predators of aquatic and terrestrial insects, small fish, frogs, and mice; but their primary diet consists of benthic aquatic insect larvae, particularly caddisflies (*Trichoptera*), midges (*Chironomidae*), and mayflies (*Ephemeroptera*) (Merz 2002). Depending on season and steelhead size, they also may eat salmon eggs, juvenile salmon, sculpins, and suckers (Merz 2002).

Historically, Central Valley steelhead adult abundance was probably on the order of 1–2 million fish (McEwan 2001:19) and had declined to 40,000 fish by the early 1960s (DFG 1965, cited by McEwan 2001:18). The counts of adult steelhead at RBDD have declined from an annual average count of over 11,000 fish in the 10-year period beginning in 1967, to around 2,200 in the 1990s (McEwan and Jackson 1996, cited by McEwan 2001:19). The most recent estimate of the number of female spawners was based on back-calculation from the number of juveniles collected in research trawls and was approximately 3,600 fish (Lindley 2005a:291). The primary limiting factor for Central Valley steelhead is the inaccessibility of the great majority (82–95 percent) of historical spawning and rearing habitat due to major dams (McEwan 2001:21). Other limiting factors include small passage barriers, water development and land use activities, levees and bank protection, dredging and sediment disposal, mining, contaminants, fisheries management practices, hatcheries, inadequately screened water diversions, and predation by non-native species (McEwan 2001; Moyle et al. 2008; NMFS 2009).

Little Kern Golden Trout

The Little Kern golden trout is endemic to the Little Kern River (Fresno County) and its tributaries (Moyle et al. 2008:217). It is a rainbow trout subspecies that resulted from isolation of the Little Kern River from the remainder of the Kern River by natural barriers. The subspecies currently is found in several small, isolated tributaries of the Little Kern River's headwaters.

The life-history of the Little Kern golden trout has not been well studied; it is assumed to be similar to that of the California golden trout (Moyle et al. 2008:217). The California golden trout is physiologically adapted to thrive in relatively cold, alpine streams (10–19°C) that are characterized by short growing seasons and low productivity (Myrick and Cech 2003, Knapp and Dudley 1990, both in Moyle et al. 2008). It is a small species relative to other salmonids, with the result that it uses relatively small-diameter substrates for spawning (4–12 mm), occupies shallow water during spawning (5–20 cm), and buries eggs to relatively shallow depths (40–60 mm) (Knapp and Vredenburg 1996:519–529). Water flow at egg deposition sites is between 30 and 70 cm/s^{-1} (with 45–55 cm/s^{-1} selected most often) (Knapp and Vredenburg 1996:527). Reproduction occurs at age 3 or 4 and begins in May, or when maximum daily temperatures are consistently greater than 15°C (Knapp and Vredenburg 1996:528). The temperature range during spawning (15–21°C) is relatively warm for salmonids (Knapp and Vredenburg 1996:528). Eggs incubate for 20 days at a temperature of 14 °C, and fry emerge from the gravel 2–3 weeks after hatching at a size of 25 mm total length (Moyle et al. 2008:210). Habitat requirements of the Little Kern golden trout are the same as those of California golden trout (Moyle et al. 2008:217) and include a preference for pool habitat, emergent vegetation, and undercut banks (Matthews 1996). Prey consists of terrestrial and aquatic invertebrates, particularly adult and larval insects, with feeding occurring all day and night but more so during the day (Moyle et al. 2008:210). Lifespan of the California golden trout is up to 9 years (Knapp and Dudley 1990).

Threats to the Little Kern golden trout are primarily due to planting of rainbow trout, which may cause unwanted hybridization and loss of genetic diversity, and competition with illegally planted brown trout (Moyle et al. 2008:218).

Critical habitat for the Little Kern golden trout has been designated to include all of the Little Kern River and its tributaries above the barrier falls 1 mile below the mouth of Trout Meadows Creek (50 FR 15428). In listing the species and designating critical habitat, USFWS noted that increased temperature and siltation could occur due to "uncontrolled use of ORV's [off-road vehicles], improper road construction, careless logging activities, pollution from mining operations or overgrazing in a large portion of the drainage basin" (50 FR 15428).

Conservation efforts for native trout, including the Little Kern golden trout, have included construction of barriers to prevent hybridization with non-native trout that have moved upstream, destruction and removal of non-native trout and hybrids with poison and netting, and rearing and release of hatchery-raised fish (Moyle et al. 2008:211–212, 217). The species has increased from a low distribution of only 16 km of stream in 1973 to over 51 km and three headwater lakes in 1998 (Moyle et al. 2008:217). It is estimated that the current abundance of pure, unhybridized Little Kern golden trout of greater than 1 year old is approximately 5,000–6,000 fish (Moyle et al. 2008:218). A DFG management plan for the species was completed in 1978 and was revised in 1984 and 1995. Moyle et al. (2008:219) recommend that the plan requires further revision because of the issue of past hybridization that has not fully been resolved by management actions to date.

Central Valley Fall-/Late Fall–Run Chinook Salmon ESU

The Central Valley fall-/late fall–run Chinook salmon ESU includes all natural populations in the Sacramento and San Joaquin River Basins and their tributaries. Fall-run Chinook salmon are the most abundant run in the Central Valley and are the principal run raised in hatcheries (Moyle 2002; Williams 2006). Both wild and hatchery-origin fish exist in the Central Valley, and the proportion of hatchery fish in mixed-stock ocean fisheries may be as high as 90 percent (Barnett-Johnson et al. 2007:1688). Fall-/late fall–run Chinook salmon are produced at five hatcheries in the Central Valley (Coleman National Fish Hatchery on Battle Creek, Feather River Hatchery, Nimbus Fish Hatchery on the American River, the Mokelumne River Fish Hatchery, and the Merced River Fish Facility); the annual number of juveniles released has been over 20 million fish (Joint Hatchery Review Committee 2001:Appendix V).

Fall-run Chinook salmon migrate to spawning grounds as sexually mature adults and usually spawn from 1 to 2 months after entry. Peak spawning is from October to November, but spawning can continue through January. Substrates used for spawning tend to be a mixture of small cobble and large gravel that will allow aeration of eggs buried in redds (Moyle et al. 2008), and spawning usually occurs at the tails of holding pools at depths of 30–100 cm and water velocity of 40–60 cm/s (Moyle et al. 2008:127). Cover (such as undercut banks, submerged wood, or deeper pools) is important for various life stages, including holding adults and rearing juveniles (Bjornn and Reiser 1991:97, 133–136). Fry typically emerge from December through March and rear in natal streams for 1–7 months, usually moving downstream into the main rivers within a few weeks after emergence. Both fry and smolts can be found in the San Francisco estuary. Estuarine habitats are important rearing environments, and survival to adulthood decreases as the rate of anthropogenic alteration increases (Magnusson and Hilborn 2003). Fish spend from 2 to 5 years at sea before returning to spawn (Moyle et al. 2008). Fall-run/late fall–run Chinook salmon habitat requirements are generally similar to those of other Chinook salmon, but an important difference from races such as spring-run and winter-run (see below) is that spawning occurs soon after fresh water entry and takes place in relatively low reaches of rivers (Moyle et al. 2008). This made fall-/late fall–run Chinook salmon less susceptible to the effects of impassable dams than other runs of Chinook and steelhead in the Central Valley. Temperature is a key environmental variable and is optimal for adult migration at 10–20°C, for adult holding at 10–16°C, for spawning at 13–16°C, for egg incubation at 9–13°C, for juvenile rearing at 13–20°C, and for smoltification at 10–19°C (Moyle et al. 2008:127–128). Juveniles make extensive use of off-channel habitats such as inundated floodplains where they grow faster because of warmer water temperatures and abundant food (Moyle et al. 2008; Sommer et al. 2001). Relatively abundant food may offset the higher metabolic costs of high-temperature environments such as inundated floodplains (Moyle et al. 2008).

The natural-origin fall-/late fall–run Chinook population has fluctuated since the 1960s and has declined during the last several years from an average escapement of almost 330,000 in 1992–2006 (with a low of around 88,000 fish in 1992) to around 88,500 fish in 2007 and less than 60,000 fish in 2008 (AFRP 2009). Low abundance in 2008 and forecasted low abundance in 2009 led to the closure of almost all fisheries in California. The current low abundance is thought to be due to warmer ocean conditions delaying coastal upwelling and limiting productivity of nearshore waters for juvenile Chinook (Lindley et al. 2009:32, 35). Other factors affecting the fall-run/late fall–run Chinook salmon include negative effects of water diversions (both through loss of individuals and through false triggers to migration by altered hydrodynamics), hatchery-reared fish (e.g., hybridization and competition), harvest (often due to increased fishing effort triggered by the presence of hatchery-reared fish), loss of habitat (particularly behind dams but also due to armoring of river banks for flood protection), pollution (e.g., municipal discharges and agricultural runoff), and alien species (particularly predators such as striped bass [*Morone saxatilis*]) (Moyle et al. 2008:141–143).

Central Valley Spring-Run Chinook Salmon ESU

The Central Valley spring-run Chinook salmon ESU includes all naturally spawned populations in the Sacramento River and its tributaries in California, including the Feather River, and one artificial propagation program: the DFG Feather River Hatchery spring-run Chinook salmon program. There are only three remaining independent populations (Mill, Deer, and Butte Creeks); their geographic proximity to each other makes these populations susceptible to a regional disaster such as a large forest fire or volcanic eruption (Lindley et al. 2007:11).

Returning Central Valley spring-run Chinook migrate upstream as sexually immature fish in spring, hold through summer in deep pools, spawn in early fall, and migrate downstream as juveniles after either a few months or a year in fresh water (Moyle et al. 2008). Spawning migration extends from February to early July, with peaks in mid-April in Butte Creek and in mid-May in Deer and Mill Creeks (Williams 2006). Central Valley spring-run Chinook attain maturity at ages of 2–4 years. They generally migrate higher into watersheds than other runs in order to find deep pools where cooler temperatures allow over-summering (Moyle et al. 2008). Spawning often occurs in the tailwaters of their final holding pool (Moyle 2002). Preferred spawning habitat seems to be at depths of 25–100 cm and at water velocities of 30–80 cm/s (Williams 2006). Incubation lasts from 40 to 60 days and is extremely sensitive to temperature, with high egg mortality at temperatures above 14–16 °C. Fry emerge in another 4–6 weeks (Williams 2006). Migration can begin within hours of emergence, after a few months of natal rearing, or after over-summering in the natal stream (Hill and Webber 1999; Moyle et al. 2008). Central Valley spring-run Chinook salmon are probably largely ocean-type fish (i.e., migrating downstream as relatively young fish in April and May, as occurs in Central Valley fall-run/late fall–run Chinook), but some individuals remain to rear until fall or winter and migrate at 12–15 months old (Moyle et al. 2008:167; NMFS 2009:94). As Central Valley spring-run Chinook travel downstream, they may rear in the lower reaches of non-natal tributaries and along mainstem margin habitats—particularly smaller fish that need to grow larger before ocean entry (Moyle et al. 2008). Juveniles feed mainly on zooplankton, benthic invertebrates, terrestrial drift, and larvae of other fishes—especially suckers (Moyle 2002; Moyle et al. 2008).

The abundance of Central Valley spring Chinook salmon has declined from run sizes of perhaps 600,000 adults between the late 1880s and 1940s (DFG 1998, cited by NMFS 2009:94) to tens of thousands of individuals in recent years; total abundance of natural-origin fish was less than 5,000 spawners in 2008 (AFRP 2009). According to Lindley (2005b:153), there are three primary limiting factors to Central Valley spring-run Chinook:

- Loss of most historical spawning habitat due to impassable dams,
- Degradation of remaining habitat, and
- Genetic threats from the Feather River Hatchery spring-run Chinook salmon program.

Other limiting factors include water diversions, unscreened or inadequately screened water diversions, excessively high water temperatures, predation by non-native species, urbanization and rural development, logging, grazing, agriculture, mining, estuarine alteration, fisheries management, and “natural” factors such as ocean upwelling (Moyle et al. 2008; NMFS 2009). Efforts to recover the populations within the ESU, such as gravel placement, have achieved some success. Although they lacked spring-run for many years prior, Battle Creek and Clear Creek each averaged 100–200 spring-run Chinook spawners over the past 3 years (DFG 2009c).

Sacramento River Winter-Run Chinook Salmon ESU

The Sacramento River winter-run Chinook salmon ESU includes all naturally spawned populations in the Sacramento River and its tributaries, as well as two artificial propagation programs: winter-run Chinook from the Livingston Stone National Fish Hatchery and winter-run Chinook in a captive brood stock program maintained at Livingston Stone National Fish Hatchery and the University of California, Davis, Bodega Marine Laboratory.

Winter-run Chinook occur in areas with a continuous supply of cold water, such as the spring-fed streams of the basalt and porous lava region of northeastern California (Moyle et al. 2008). They occur only in the Sacramento River Basin because they require water temperatures sufficiently cold in summer to enable successful incubation and sufficiently warm in winter to support juvenile rearing (Moyle et al. 2008; Stillwater Sciences 2006 in Moyle et al. 2008). Winter-run Chinook historically migrated high into the watersheds of the McCloud, Pit, and upper Sacramento Rivers to spawn. This habitat was lost with construction of Shasta Dam in the 1940s (Moyle et al. 2008).

Winter-run Chinook life-history timing differs considerably from the other three Central Valley Chinook salmon races. Winter-run spawning migration extends from January to May, with a peak in mid-March. They enter fresh water as sexually immature adults and migrate upriver to the reaches below Keswick Dam, where they hold for several months until spawning in April through early August (Moyle et al. 2008; Williams 2006). Optimal temperatures for holding range from 10 to 16°C, and optimal water velocities range from 47 to 125 cm/s (USFWS 2003). Incubation, which is the most temperature-sensitive life-history stage, occurs in the hottest part of the year and is facilitated by cold water releases from Shasta Reservoir (Moyle et al. 2008). To ensure moderate redd temperatures, winter-run Chinook spawn at depths of 1–7 m (Moyle 2002). Fry emerge from the gravel from July through mid-October (Moyle et al. 2008; Williams 2006; Yoshiyama et al. 1998). After emergence, juveniles are restricted in their rearing habitat to those reaches that maintain cool summer temperatures. Flows above 15,000 cfs in the Sacramento River at Wilkins Slough trigger downstream migration toward the Delta, beginning in October for fry-sized fish (less than 70 mm fork length) (R. del Rosario and Y. Redler, NMFS, unpublished data). Rearing in the Delta lasts from 2.5 to 3 months on average; earlier entry to the Delta results in longer residence there. Exit from the Delta occurs later when the Yolo Bypass is inundated, indicating that this habitat is used for rearing. The majority of the population leaves the Delta in March, with the first emigrants leaving after pulse flows greater than 20,000 cfs measured at the Sacramento River at Freeport (R. del Rosario and Y. Redler, NMFS, unpublished data).

The number of spawning winter-run Chinook salmon was as high as nearly 120,000 fish in 1969, before a precipitous decline to less than 200 individuals in some years of the early 1990s (AFRP 2009). The biggest single cause of winter Chinook salmon decline was the loss of access to spawning areas caused by construction of Shasta and Keswick Dams in the 1940s. Other ongoing factors include the existence of only one population, with a low population size; climate variability (e.g., drought); unscreened or inadequately screened water diversions; predation; pollution (e.g., from the Iron Mountain Mine); adverse flow and water quality conditions leading to high water temperatures; fisheries management; passage barriers (e.g., RBDD); and degraded spawning habitat (Moyle et al. 2008). Lindley and Mohr (2003) calculated that an increase in striped bass abundance to historical levels (i.e., 3 million adults) would considerably increase the extinction risk of winter-run Chinook salmon. Implementation of the conservation hatchery program for winter-run Chinook salmon in the early 1990s has successfully begun to restore the population; the number of spawners topped 15,000 in 2005 and 2006. Lower numbers of fish (less than 3,000) in 2007 and 2008 are probably attributable to the reduced ocean productivity that has affected all runs of Chinook salmon from the Central Valley (Lindley et al. 2009).

Modoc Sucker

In California, the Modoc sucker occurs only in portions of the Turner and Ash Creek Watersheds, two drainage systems of the Pit River in Modoc County (Moyle 2002:189–190). The species also occurs in tributaries of Goose Lake in Oregon. These tributaries include Washington, Hulbert, and Johnson Creeks and two smaller unnamed feeder streams.

Optimal habitat for Modoc suckers includes low- to moderate-flow streams with large shallow pools, ample cover (e.g., riparian vegetation or undercut banks), soft sediments, and moderately clear water (Moyle 2002:190). As stream habitat in lower reaches may dry up in summer, Modoc suckers need adequate water flow and optimal temperatures during April and May to migrate upstream in order to spawn and find refuge. After spawning, eggs adhere to the bottom substrate. Sexual maturity usually occurs at age 3, although males may mature sooner, and they live for only 4–5 years. Modoc suckers primarily feed on detritus and filamentous algae, as well as aquatic insect larvae and crustaceans (Moyle 2002: 190).

Several interacting factors are primarily responsible for decline of the Modoc sucker (Moyle 2002:190–191). Channelization of streams has eliminated much of the pool habitat that the species requires. Grazing by cattle, exacerbated by road building and logging, has reduced the amount of streamside vegetation cover and has increased sedimentation into pools. Flows reduced by water diversions and dams limit fish movement. Predation by brown trout, the most piscivorous (fisheating) of California's non-native trouts, is likely to have reduced the abundance of the Modoc sucker. Hybridization with the more common Sacramento sucker (*Catostomus occidentalis*) may have caused the species to decline and was a result of the removal of natural barriers to Sacramento sucker upstream migration (e.g., waterfalls; 50 FR 24523). However, hybridization "is apparently rare and insufficient to create problems for the Modoc sucker" (Moyle 2002:189).

Critical habitat designated for the Modoc sucker by USFWS in 1985 (50 FR 24526) consists of 26 stream miles and a 50-foot riparian zone within the watersheds of Turner, Washington, Hurlbert, Johnson, and Rush Creeks. Activities that may adversely modify critical habitat include (50 FR 24528) overgrazing by livestock in areas adjacent to streams; channelization, impoundment, and water diversions; introduction of additional exotic species that may compete with or prey on Modoc suckers; application of herbicides or insecticides that are toxic to Modoc suckers or their food sources; pollution of streams by silt or other pollutants; and removal of streamside trees or bushes that would reduce shade and cover, thereby reducing suitability of the habitat.

Moyle (2002:191) notes that much progress has been made in restoring the Modoc sucker populations by improving habitat through actions such as fencing of streams to exclude cattle and installation of barriers to prevent upstream migration of Sacramento sucker. He states (Moyle 2002:190): "…today their situation is secure enough that upgrading the species to threatened status can seriously be considered."

5.8.4 Existing Effects of Impaired Water Quality on Fish

Impaired water quality in the water column or sediment contamination may kill fish from direct, acute exposure or cause energy reallocation, increase susceptibility to disease and predation, reduce reproductive success, and increase behavioral abnormalities, which all may contribute to decreased evolutionary fitness (Werner et al. 2008:1). Migratory ability also may be affected (e.g., in salmonids) (NMFS 2008b).The majority of agricultural effects on surface water quality occur below the major storage reservoirs in the Central Valley; however, effects also are associated with irrigation of pasture at higher elevations. The general effects of agriculture on water quality include changes in water column toxicity, sediment toxicity, detectable pesticides, and salinity, among others. As noted in Section 5.7, Vegetation and Wildlife, irrigation seepage can contaminate groundwater underlying porous soils that are heavily fertilized or that receive pesticide applications. Constituents of concern in Central Valley groundwater that are related to agriculture include nutrients, pesticides, salt, trace elements, organic carbon and disinfection byproduct precursors, and microorganisms. Sources of these constituents are discussed in Section 5.9, Hydrology and Water Quality. Groundwater does not affect fish directly but becomes important when it enters water bodies as surface water (e.g., as base flow during low-runoff months). Therefore, the impacts analysis related to surface water quality is relevant to groundwater quality impacts on fish.

Sources of Information

Assessment methods for determining the existing water quality impairment effects on fish focused largely on recent studies relevant to nonpoint source runoff within the program area—especially with respect to pesticides, which are perhaps of greatest concern among the constituents from irrigated lands and other lands included in the ILRP. Much of the information in the analysis of existing effects addresses the potential effects on salmonids because these species have received the most study. Where possible, existing information related to other species is provided. In examining existing uses of pesticides and potential impacts on aquatic resources in the San Francisco estuary watershed, Kuivila and Hladik (2008) noted that analyses to date are subject to several limitations:

- Monitoring studies analyze fewer than half of the pesticides applied in the watershed.
    - Testing procedures may not be well developed or tests may be different from the majority of pesticides that are being analyzed.
- Pesticide use changes over time.
    - For example, molinate (a rice pesticide) was no longer sold or distributed after June 30, 2008.
- Most knowledge relates to dissolved pesticides in the upper watershed.
    - Monitoring usually occurs in small creeks as opposed to larger systems such as the Delta.
- There is no comprehensive long-term monitoring of current-use pesticides.

The programmatic analysis of effects on fish associated with the existing ILRP therefore is primarily qualitative. The main sources of information used in the analysis of existing effects include:

- The results of water quality monitoring over 2004–2006 for the ILRP by coalition groups and others that tested for toxicity to fathead minnow (see ICF Jones and Stokes 2008),
- EPA assessments of the potential effects of a number of pesticides on listed salmonid ESUs in the Central Valley,
- NMFS biological opinions on EPA's proposed registration of certain pesticides, and
- Various published and unpublished studies.

The first three items are described in more detail below.

Central Valley Water Board *2007 Review of Monitoring Data for ILRP*

As noted in Section 5.9, Hydrology and Water Quality, water quality monitoring by grower coalitions and others has been conducted for the ILRP since 2003 (Central Valley Water Board 2007). The toxicity testing of the surface water column using fathead minnows (*Pimephales promelas*) is of particular relevance in determining potential impacts on fish. The fathead minnow generally is considered a good indicator of the potential toxic effects of ammonia and the effects of pesticides at higher concentrations than may affect other, non-fish test organisms (Central Valley Water Board 2007:I-8). Testing is limited to acute toxicity and does not include potential chronic and long-term effects, such as reproductive impairment. Tests evaluate whether mortality of test organisms (percent dying) is statistically significantly different from laboratory control organisms when exposed to ambient water for 96 hours. As noted by the Central Valley Water Board (2007:I-4):

> Some areas of the Central Valley have been monitored at a consistent frequency over the three-year period comprising six to eight sampling events per year. Other areas within the Central Valley have a much lower frequency of monitoring from which to infer findings from the water quality data. These data limitations need to be considered.

Analysis of potential effects of the ILRP was made with reference to the results of the fathead minnow toxicity testing and other testing detailed by the Central Valley Water Board (2007).

The raw data used by the Central Valley Water Board (2007) were used to assess existing conditions for water quality constituents not described in the *2007 Review of Monitoring Data for ILRP*. It should be noted that these data often were collected in small tributaries and agricultural drains that may not be representative of conditions in the ranges of special-status species.

EPA Assessment of Pesticide Effects and NMFS Biological Opinions

As noted under "Regulatory Framework" above, EPA is conducting court-ordered assessments of the potential effects from continued EPA approval of a number of pesticide active ingredients on ESA-listed Pacific anadromous salmonids and San Francisco estuary terrestrial and aquatic species. These assessments include four fish species within the ILRP program area: the Central Valley spring-run Chinook salmon ESU, the Sacramento River winter-run Chinook salmon ESU, the California Central Valley steelhead DPS, and delta smelt. The EPA Office of Pesticide Programs (OPP) has conducted a risk assessment for each of the pesticide active ingredients and several others using the following framework (Turner 2002a):

- Aquatic toxicity: Acute (survival) and chronic (primarily reproductive) effects were reviewed based on existing studies of a number of freshwater and estuarine fishes, invertebrates, and plants.
- Environmental fate and transport: Degradation and mobility within soils were judged from existing information.
- Incidents: Two OPP databases of registered incidents (e.g., spills) involving the active ingredients were queried.
- Estimated and actual concentrations in water: Existing models were used to provide estimated environmental concentrations (EECs), which were used in conjunction with actual local monitoring data.
- Recent changes in pesticide active ingredient registrations: Changes to the registration (e.g., to mitigate risk to aquatic species) are reviewed.
- Existing protections: National, state, and local protective measures were reviewed.

In 2008, NMFS issued a BO on the effects of EPA's registration of chlorpyrifos, diazinon, and malathion on listed salmonids using the analyses conducted by EPA and other information. The BO used a risk assessment (Figure 5.8-1) process to examine several risk hypotheses:

1. Exposure to chlorpyrifos, diazinon, and malathion is sufficient to:
    a. Kill salmonids from direct, acute exposure;
    b. Reduce salmonid survival through impacts to growth;
    c. Reduce salmonid growth through impacts on the availability and quantity of salmonid prey;
    d. Impair swimming which leads to reduced growth (via reductions in feeding), delayed and interrupted migration patterns, survival (via reduced predator avoidance), and reproduction (reduced spawning success); and

   e. Reduce olfactory-mediated behaviors resulting in consequences to survival, migration, and reproduction.

2. Exposure to mixtures of chlorpyrifos, diazinon, and malathion can act in combination to increase adverse effects to salmonids and salmonid habitat.
3. Exposure to other stressors of the action, including oxon degradates, adjuvants, tank mixtures, and other active and other ingredients in pesticide products containing chlorpyrifos, diazinon, and malathion, causes adverse effects to salmonids and their habitat.
4. Exposure to other pesticides present in the action area can act in combination with chlorpyrifos, diazinon, and malathion to increase effects to salmonids and their habitat.
5. Exposure to elevated temperatures can enhance the toxicity of the stressors of the action.

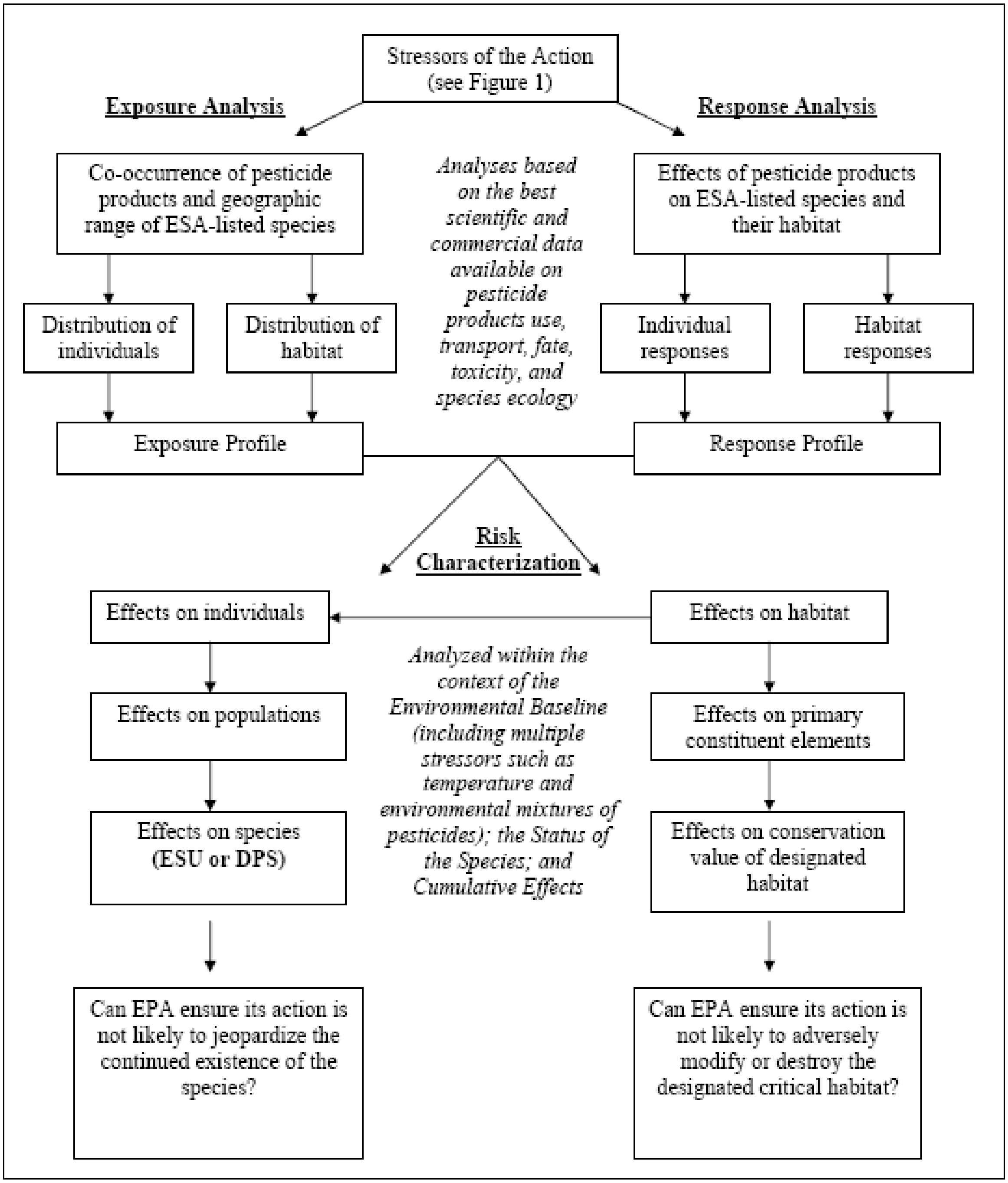

Figure 5.8-1. Conceptual Framework Adopted by NMFS to Assess Effects of EPA Registration of Pesticide Active Ingredients

Source: NMFS 2008:39.

Existing Effects by Key Parameters

The existing effects of impaired water quality are discussed by key parameters, including general toxicity, sediment, pesticides, nutrients and organics, trace elements and salts, pathogens, and temperature.

General Toxicity

Toxicity Testing of Fathead Minnows

The Central Valley Water Board (2007) summarized results of fathead minnow toxicity testing data by ILRP zone boundaries. As noted above, fathead minnows are a useful indicator of ammonia pollution as well as higher concentrations of pesticides, although it is not necessarily clear which pollutants contribute most to the toxicity results for fathead minnows. For Zones 1 and 4, tests were grouped into categories indicating reductions in survival in relation to laboratory control organisms: greater than 0- to 20-percent reductions (>0–20%), greater than 20- to 50-percent reductions (>20–50%), and greater than 50- to 100-percent reductions (>50–100%).

In Zone 1, which is comprised of the Sacramento River watershed that drains the northern part of the Central Valley into the Sacramento River, eight tests indicated statistically significant toxicity to fathead minnow (Table 5.8-3). Six of these events were found in the area of the Butte/ Yuba/ Sutter Subwatershed and two in the Colusa Basin Subwatershed (Figure 5.8-2). Overall, 1.6 percent of the total fathead minnow tests (501 total) showed statistically significant toxicity (Table 5.8-3). Six percent of the individual monitoring locations indicated toxicity to fathead minnow at least once. Four of the eight significant tests showed reductions in survival of >0–20 percent, whereas only one indicated a reduction in survival of >50–100 percent.

Table 5.8-3. Results of Toxicity Testing of Fathead Minnows in the Program Area

Zone	Number of Tests	Number of Statistically Significant Tests	Reduction in Survival Compared to Laboratory Control		
			>0–20%	>20–50%	>50–100%
1	501	8	4	3	1
2	342	11	–	–	–
3	588	13	–	–	–
4	235	22	7	11	4

Source: Central Valley Water Board 2007.

In Zone 2, which includes parts of San Joaquin, Contra Costa, Alameda, and Calaveras Counties and the Delta, 11 of 342 (3.2 percent) tests for fathead minnow toxicity were statistically significant (Table 5.8-3). Approximately 17 percent of the individual monitoring sites in Zone 2 exhibited fathead minnow toxicity during the monitoring period. Observed minnow toxicity was mostly limited to the drains in the Delta, except for the Lone Tree Creek, Marsh Creek, and Sand Creek Subwatershed monitoring points (Figure 5.8-3).

Zone 3, which is essentially the San Joaquin River drainage, resulted in 13 of 588 (2.2 percent) tests for fathead minnow toxicity that were statistically significant (Table 5.8-3). Approximately 19 percent of the individual monitoring sites in Zone 3 exhibited fathead minnow toxicity during the monitoring period (Figure 5.8-4). Toxicity to fathead minnow in Zone 3 monitoring was typically mid-range in magnitude (generally from10 to 65 percent mortality). Two of the 13 significant tests showed mortality greater than 50 percent.

Zone 4 encompasses the entire Tulare Lake Basin, including portions of Fresno, Kings, Tulare, and Kern Counties. Twenty-two of 235 (9.4 percent) tests for fathead minnow toxicity were statistically significant (Table 5.8-3). Approximately 31 percent of the individual monitoring sites in Zone 4 exhibited fathead minnow toxicity during the monitoring period (Figure 5.8-5). One-half of statistically significant toxicity tests to fathead minnow in Zone 4 monitoring was in the >20–50 percent reduction in survival range, whereas just under one-quarter (4 of 22) of tests indicated a reduction in survival of >50–100 percent.

Recent Toxicity Testing in the Delta

Werner et al. (2008) conducted toxicity testing from 2005 to 2007on juvenile striped bass and delta smelt using water collected from various locations in the Delta. The main findings included:

- No reduction in survival or growth of juvenile striped bass compared to control fish (however, only two tests were carried out);
- Reduction in survival of larval and juvenile delta smelt that was related to differences in turbidity and conductivity between sites, although there was some indication that ammonia also may have reduced survival;
- No inhibition of acetyl-cholinesterase—which would indicate sublethal effects of organophosphate or carbamate insecticides—from brain and muscle tissue of striped bass and Delta smelt; and
- Significant expression of stress-responsive genes in juvenile striped bass.

In general, these results provided some evidence for negative effects of general toxicity in the Delta, but the effects were subtle and not readily apparent at the whole-organism level.

Role of Contaminants in the Pelagic Organism Decline

As noted in the species profiles of delta and longfin smelt, the recent declines in these and other pelagic species in the San Francisco Bay-Delta have been termed the POD. Abundance indices of delta and longfin smelt, striped bass, and threadfin shad exhibited substantial decreases in 2000–2002 (Johnson et al. 2010). Factors implicated in the POD include water diversions, non-native species, and contaminants. Historical water chemistry, toxicity, and histopathological data for the legal Delta and a surrounding 30-mile buffer were reviewed to assess the feasibility of integrating population ecology with ecotoxicology to investigate the role of contaminants in the POD (Johnson et al. 2010). Several major conclusions were reached from this review:

- Few chemicals have sufficient data available to draw conclusions about the role of contaminants in the POD.
- Toxicity in water samples collected in the Delta in the pre-POD years was equal to or greater than samples in the POD years.
- Data from the pre-POD period are insufficient to determine whether lesions in fish were more or less common or severe compared to the POD years.
- Overall, while contaminants are unlikely to be a major cause of the POD, they cannot be eliminated as a possible contributor to the decline.

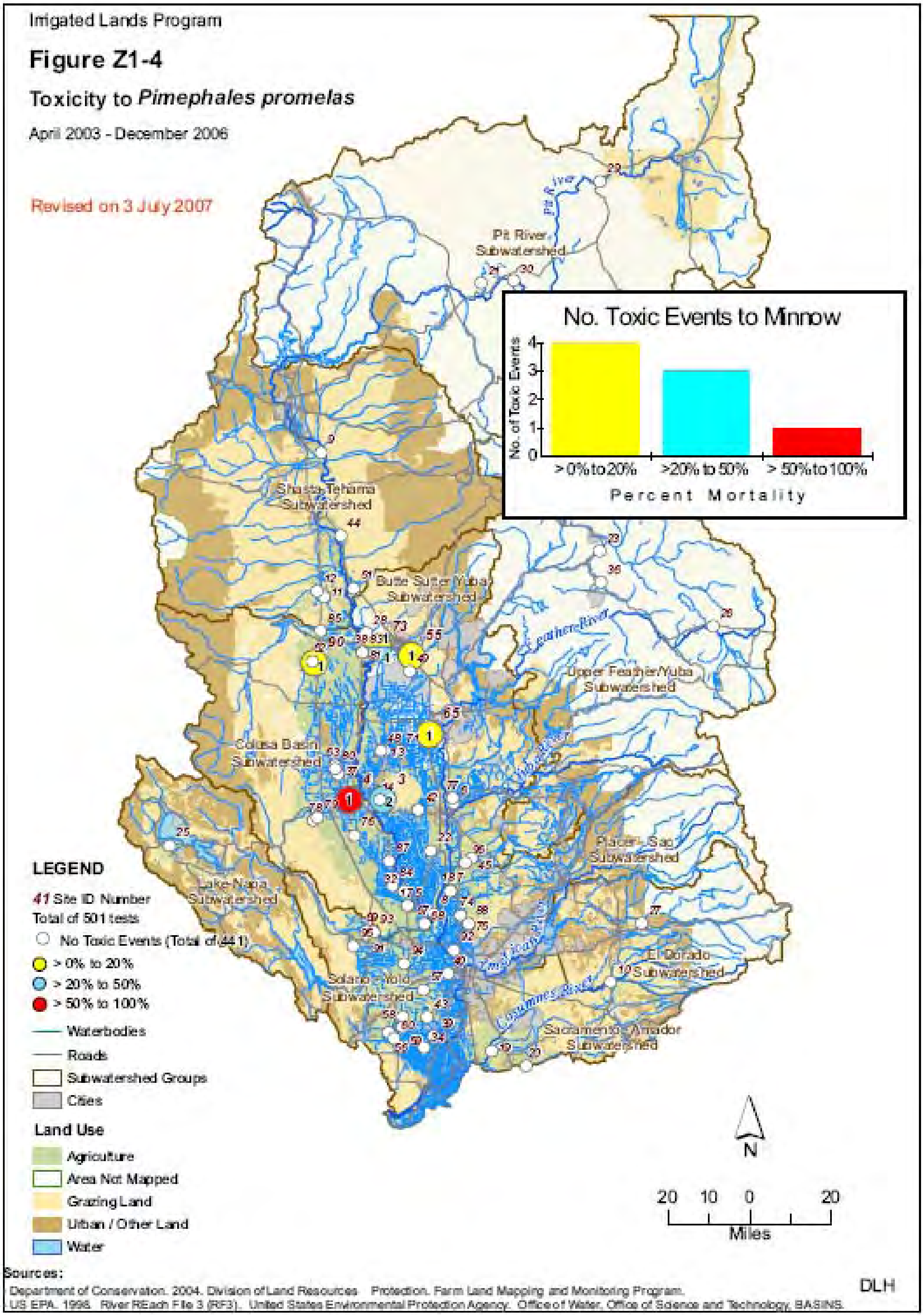

Figure 5.8-2. Toxicity to Fathead Minnow (*Pimephales promelas*) in Zone 1 of the ILRP
Source: Central Valley Water Board 2007.

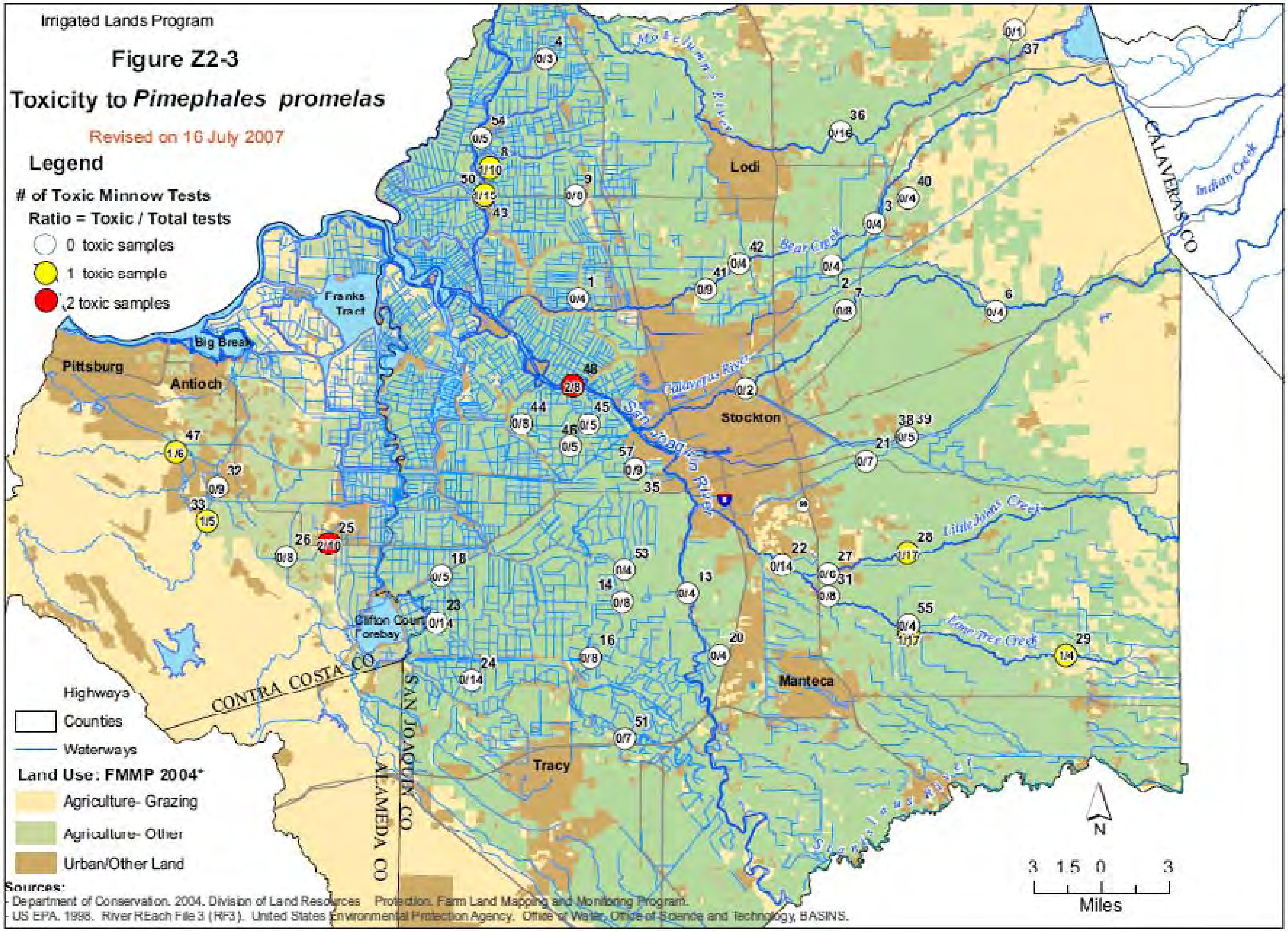

Figure 5.8-3. Toxicity to Fathead Minnow (*Pimephales promelas*) in Zone 2 of the ILRP

Source: Central Valley Water Board 2007.

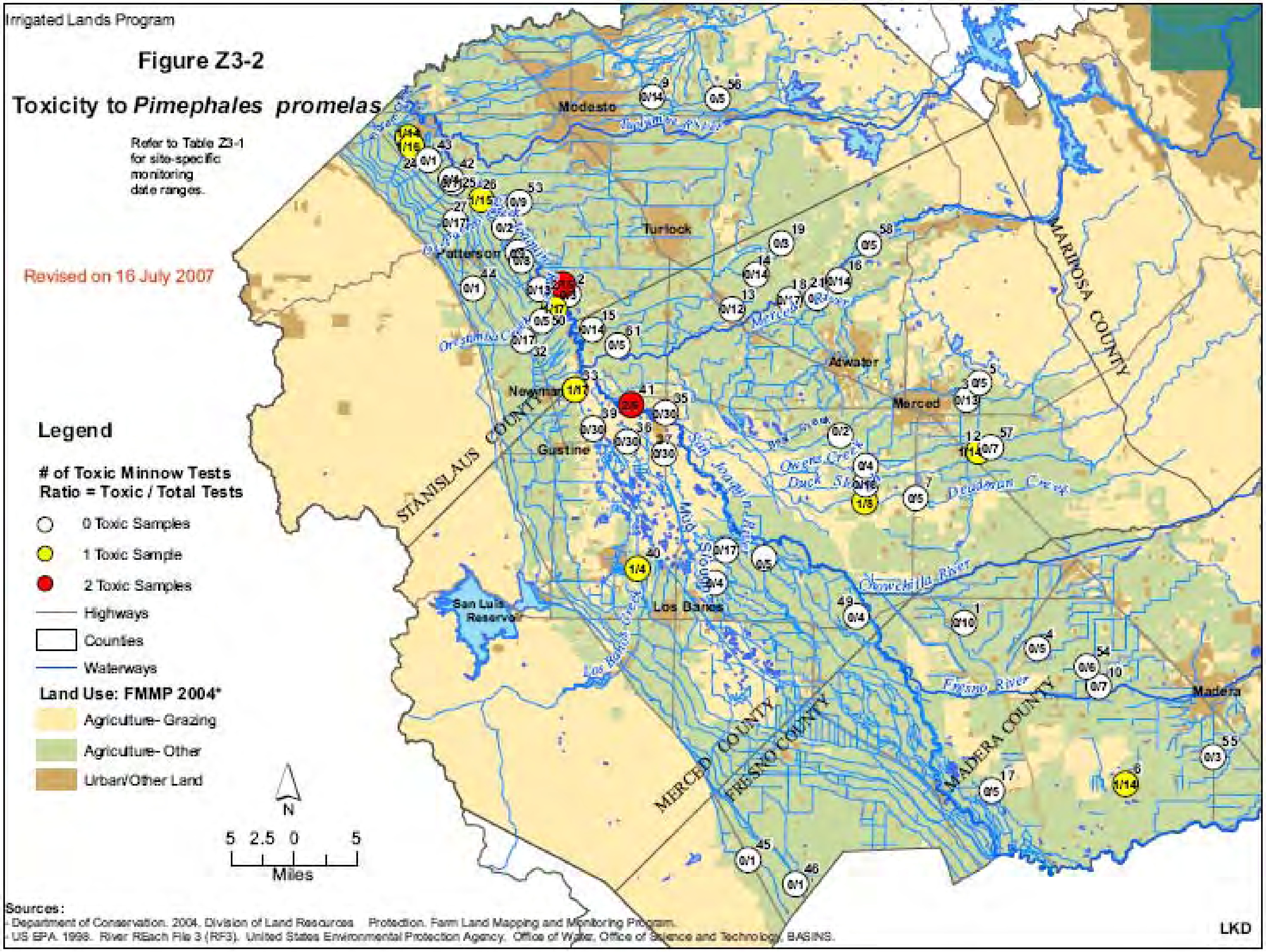

Figure 5.8-4. Toxicity to Fathead Minnow (*Pimephales promelas*) in Zone 3 of the ILRP

Source: Central Valley Water Board 2007.

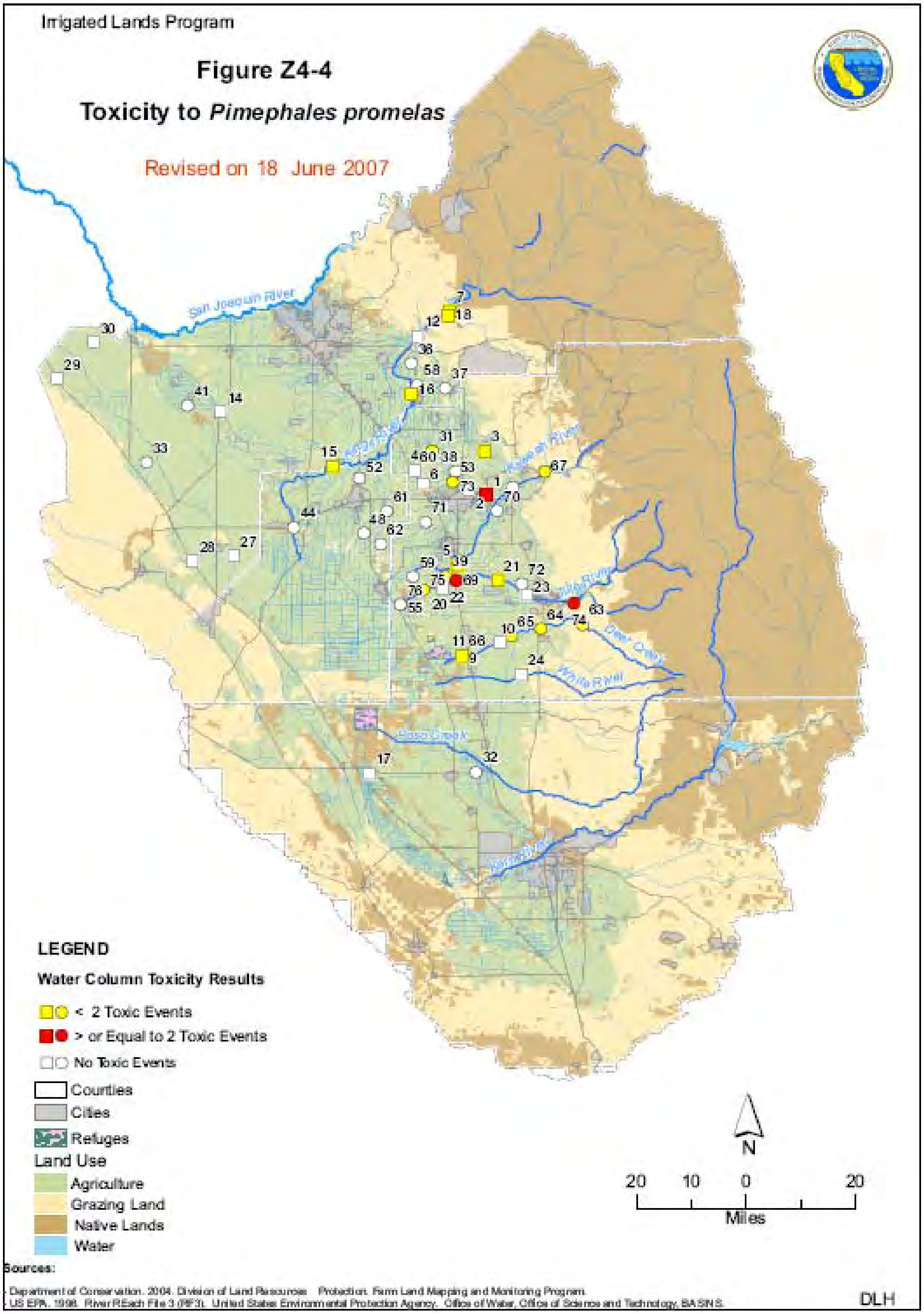

Figure 5.8-5. Toxicity to Fathead Minnow (*Pimephales promelas*) in Zone 4 of the ILRP
Source: Central Valley Water Board 2007.

Summary results of the review are presented in Table 5.8-4.

Table 5.8-4. Summary of Data Review and Analyses of the Role of Contaminants in the Pelagic Organism Decline

	Data Sources Reviewed and Main Findings		
Analysis	**Chemistry**	**Toxicity**	**Histopathology**
Pre-POD vs. POD years	Greater concentrations of chemicals in pre-POD years	As much or more toxicity in pre-POD years	Insufficient data from the pre-POD period
2000–02 vs. 2003–08 (i.e., period of greatest decline vs. post-decline)	Lack of data for comparison	No difference in the percentage of toxic water samples for *C. dubia* and *P. promelas*	Insufficient data
January–June (period of susceptibility of young fish and high runoff)	Chlorpyrifos: more than 5% of samples contained toxic concentration. Diazinon: approximately 5% of samples contained toxic concentration.	Delta waters: percentage of toxic samples less than in tributaries but indicates potential for toxicity to preys utilized by POD species	No applicable data. Some lesions were described as developing in the fall.
POD species vs. non-POD species	POD species are not always more sensitive to chemicals (striped bass are more sensitive to chlorpyrifos than non-POD species)	No applicable data	Little evidence of major histopathologies for both POD and non-POD species (2004–2007)
Impacts on prey items	Toxicity to prey items possible (limited data available)	Potential for toxicity to prey items based on toxicity test results	Full stomachs of captured individuals indicates that prey items of POD species have not been reduced by exposure to contaminants

POD = Pelagic Organism Decline.
Source: Johnson et al. 2010.

Sediment

Excessive sedimentation and turbidity is considered the main threat to fish habitat in the United States (Henley et al. 2000). Excessive sedimentation and turbidity may lead to:

- Decreased light penetration, leading to reduced phytoplankton production and reduced food availability for higher trophic levels, including fish and their prey;
- Reduction of the amount of interstitial space within streambed gravel, resulting in less habitat available for some fish prey (aquatic invertebrates) and reduced permeability for fish that spawn in gravel (e.g., salmonids);
- Migration of fish away from turbid waters;
- Reduced DO;
- Thickening of gill epithelia (tissue) and reduced respiratory function; and
- Depressed feeding rates of fish that rely on vision (Henley et al. 2000).

Turbidity goals vary for different basins within the program area and are dependent on ambient conditions. Some species, such as delta smelt, apparently require or seek a certain amount of turbidity. Juvenile and subadult delta smelt are rarely found in waters with Secchi depth greater than 75–100 cm (Feyrer et al. 2007; Nobriga et al. 2008); laboratory survival of larval delta smelt was zero at 0 NTU (nephelometric turbidity units) and increased to approximately 45% at 5 NTU and 60% at 20 NTU (Lindberg and Baskerville-Bridges 2006).

Newcombe and Jensen (1996) modeled the effects of suspended sediment on salmonids and other fish by calculating a severity-of-ill-effect score (a 15-point scale ranging from no effect to more than 80 percent mortality) as a function of total suspended sediment concentration (mg/l) and duration of exposure. Total suspended solids data collected by the ILRP may be used to assess the effects of total suspended sediment. The data are not continuous estimates but are still informative with respect to analyzing potential effects. For each monitoring site in Zones 1 and 3 (data were not available for Zones 2 and 4), it was assumed that the minimum total suspended solids value obtained was present over the long term (365 days, or 8,760 hours) and that the maximum value obtained was short term (24 hours). The severity of response was calculated from the following equation, which was developed by Newcombe and Jensen (1996) for salmonids in freshwater:

$$\text{Severity-of-ill-effect score} = 1.0642 + 0.6068\,(\ln(\text{duration})) + 0.7384\,(\ln(\text{total suspended solids}))$$

The severity at each site was calculated as the average of the short-term and long-term values. The analysis indicated that most (72 percent) sites in Zone 1 had severity-of-ill-effect scores of 6–7, indicating moderate physiological stress and impaired homing (Table 5.8-5). Nearly all (93 percent) sites in Zone 3 had severity scores of 7–9, with the majority having a score of 8 (major physiological stress).

Table 5.8-5. Suspended Sediment Severity-of-Ill-Effect Scores by Site

Severity Score	Description	Number of Sites	
		Zone 1	Zone 3
0	No behavioral effects	0	0
1	Alarm reaction	0	0
2	Abandonment of cover	0	0
3	Avoidance response	0	0
4	Short-term reduction in feeding rates; short-term reduction in feeding success	0	0
5	Minor physiological stress; increase in rate of coughing	1	0
6	Moderate physiological stress	13	2
7	Impaired homing	11	5
8	Indications of major physiological stress; long-term reduction in feeding rate; long-term reduction in feeding success; poor condition	7	17
9	Reduced growth rate; reduced fish density	1	6
10	0–20 percent mortality; increased predation	0	0
11	>20–40 percent mortality	0	0
12	>40–60 percent mortality	0	0
13	>60–80 percent mortality	0	0
14	>80–100 percent mortality	0	0

Note. It was assumed that tests for total suspended solids mostly represent total suspended sediment.
Source: ICF analysis of ILRP data (Kulesza pers. comm.).

Pesticides

As with other toxic substances, pesticides may cause acute or chronic effects on fish. Pesticides may be dissolved or adsorbed to sediment particles (Kuivila and Hladik 2008). In the Central Valley, a study by Bailey et al. (1994) suggested that pesticide runoff from irrigated rice fields in the Sacramento River Basin reduced abundance of juvenile striped bass. However, Kimmerer et al. (2001) re-examined this finding with additional years of data and did not find the same link. Kuivila and Moon (2004) suggested that, even though their water quality sampling indicated that delta smelt larvae and juveniles were not exposed to lethal concentrations of pesticides in the Delta (from April to June of 1998–2000), the duration of exposure to sublethal levels of pesticides nevertheless My have resulted in chronic effects. As noted above, Werner et al. (2008) found no acetyl-cholinesterase inhibition from Delta water tested on brain and muscle tissue of striped bass and delta smelt, indicating that organophosphate and carbamate insecticides were not at sufficient levels to cause such an effect. The Central Valley Water Board (2007) review of monitoring data for the ILRP showed that pesticides are detected throughout the program area in surface water and are also of some concern in groundwater (ICF Jones and Stokes 2008), as described in Section 5.9, Hydrology and Water Quality. A substantial number of pesticide management plans have been implemented in the program area, particularly in the San Joaquin Valley (Figures 5.8-6 to 5.8-9), that are aimed at reducing pesticide levels in water bodies.

Impairment of olfaction (and, by implication, associated behaviors) was shown to occur in the laboratory at pesticide mixture concentrations similar to those observed in a large river (Tierney et al. 2008). Baldwin et al. (2009) recently modeled sublethal pesticide exposure (organophosphate and carbamate) and resulting reductions in feeding behavior, food ration, growth, and size at migration. They showed that presence of pesticides in concentrations typical for seasonal application may constrain the recovery of ESA-listed stocks even when exposure is only for a period of a few days. Over 20 years, seasonal exposures to a 4-day organophosphate pulse were projected to reduce spawner abundance by 73 percent relative to an unexposed control population.

Timing of Pesticide Runoff

Kuivila and Hladik (2008) summarized the main periods of pesticide runoff for the San Francisco estuary watershed (Table 5.8-6). For agricultural pesticides (i.e., non-urban uses), the main detection period ranges from January to August. This period coincides with the following life history stages of sensitive anadromous species in the IRLP area (see Table 5.8-6):

- Fall-run Chinook salmon: egg incubation, juvenile rearing (natal stream), and juvenile movement and rearing;
- Late fall–run Chinook salmon: adult migration and holding, spawning, egg incubation, juvenile rearing (natal stream), and juvenile movement;
- Spring-run Chinook salmon: adult migration and holding, juvenile rearing (natal stream), and juvenile movement;
- Winter-run Chinook salmon: all life history stages;
- Steelhead: all life-history stages;
- Delta smelt: all life-history stages;
- Longfin smelt: all life-history stages; and

- Green sturgeon: all life-history stages.

Effects of Continued EPA Pesticide Approval on Listed Central Valley Fishes

Of the 60 pesticide active ingredients for which EPA made effects determinations related to listed Central Valley anadromous salmonids, a determination of "may affect'" was made for 11 pesticides (18 percent) for winter-run Chinook salmon, 13 pesticides (22 percent) for spring-run Chinook salmon, and 16 pesticides (27 percent) for steelhead (Table 5.8-7). A similar proportion of pesticides received a determination of "may affect, but unlikely to adversely affect," ranging from 17 pesticides (28 percent) in steelhead to 19 pesticides (32 percent) in winter-run Chinook salmon. A "no effect" determination was made for 30 pesticides (50 percent) for winter-run Chinook salmon, 29 pesticides (48 percent) for spring-run Chinook salmon, and 27 pesticides (45 percent) for steelhead (Table 5.8-7).

NMFS (2008) concluded that EPA registration of chlorpyrifos, diazinon, and malathion would jeopardize the continued existence of, and destroy or adversely modify critical habitat for, the Central Valley spring-run Chinook salmon ESU, the Sacramento River winter-run Chinook salmon ESU, and the California Central Valley steelhead DPS. A reasonable and prudent alternative to the registration was provided in the BO.

EPA recently completed several analyses of the potential adverse effects of continued registration of pesticide active ingredients on delta smelt and its critical habitat. It was determined that the continued registration of alachlor, atrazine, chlorpyrifos, thiobencarb, and trifluralin "may affect, and is likely to adversely affect" delta smelt and would modify delta smelt critical habitat. For alachlor and atrazine, direct effects (acute and chronic effects on delta smelt) were not likely to occur, whereas indirect effects (reductions in invertebrate and plant food, or reduction in riparian habitat) were likely to occur (Panger et al. 2009; Corbin et al. 2009a). For the remaining pesticides, both direct and indirect effects were assessed to be likely to occur (Corbin et al. 2009b; White et al. 2009; Hartless et al. 2009). EPA is in the process of conducting analyses of the potential effects on delta smelt of several more pesticides and has initiated formal consultation with USFWS for the continued registration of alachlor, atrazine, chlorpyrifos, thiobencarb, and trifluralin.

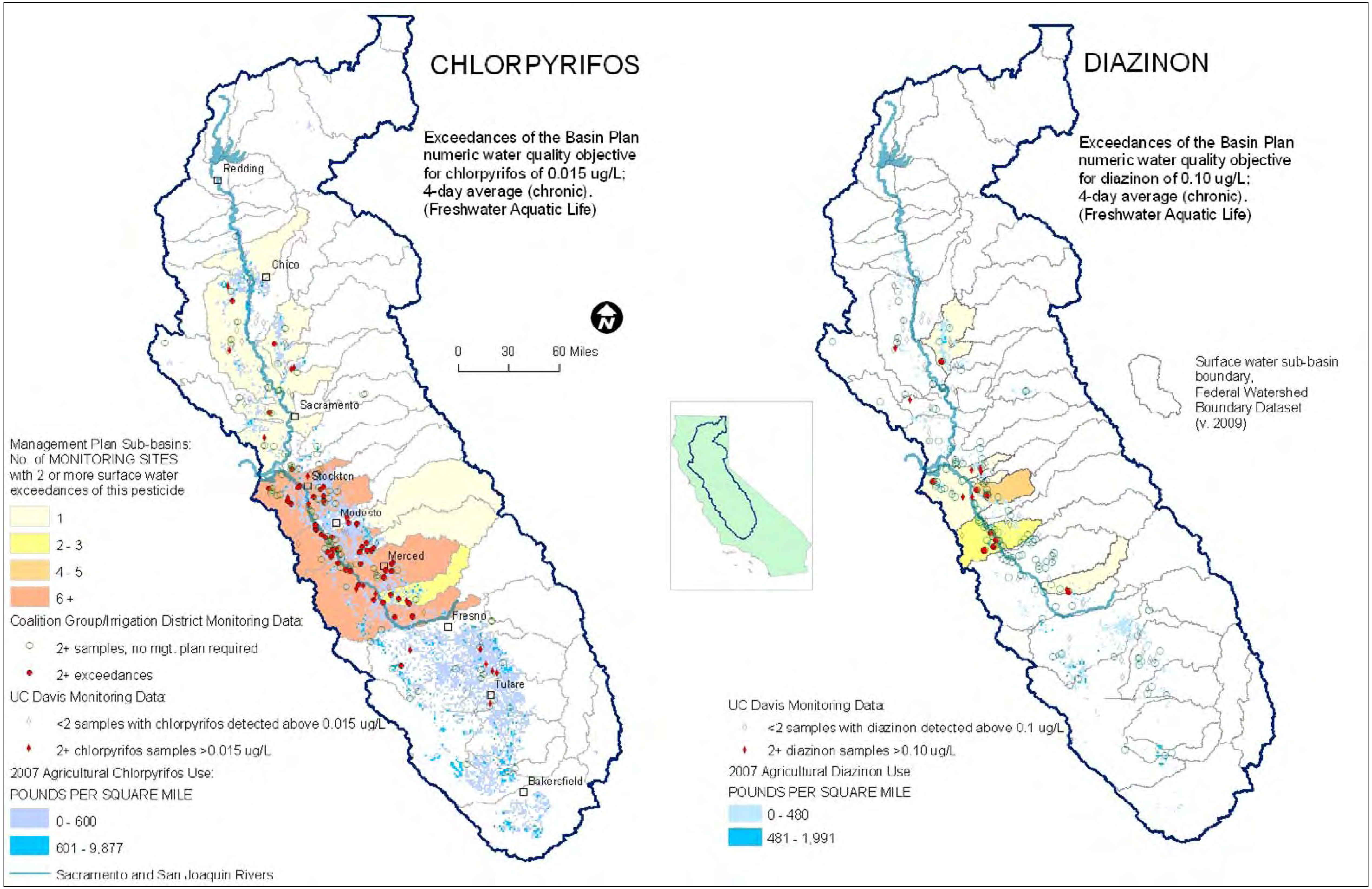

Figure 5.8-6. Chlorpyrifos and Diazinon Use, Monitoring Data, and Management Plans

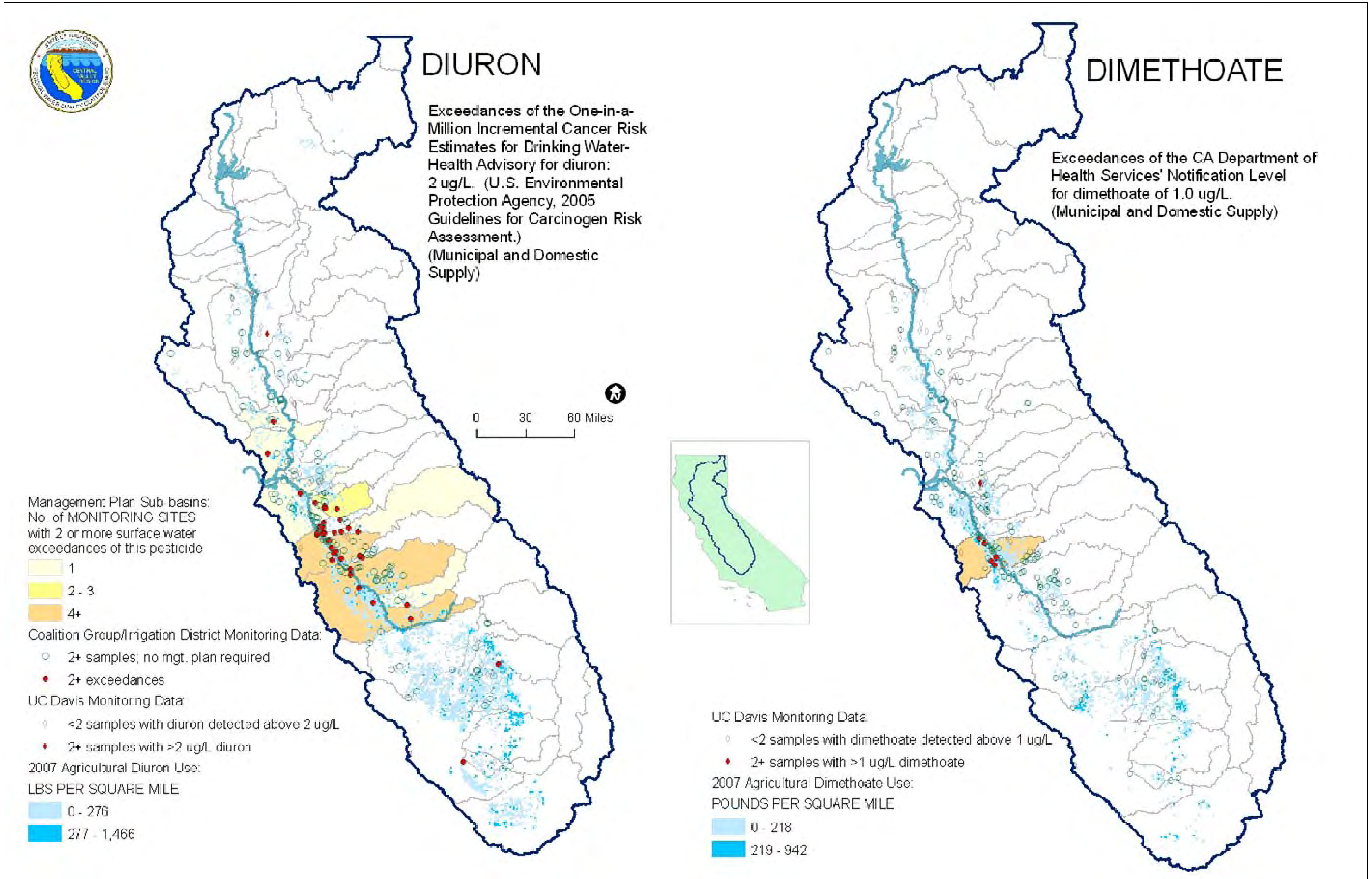

Figure 5.8-7. Diuron and Dimethoate Use, Monitoring Data, and Management Plans

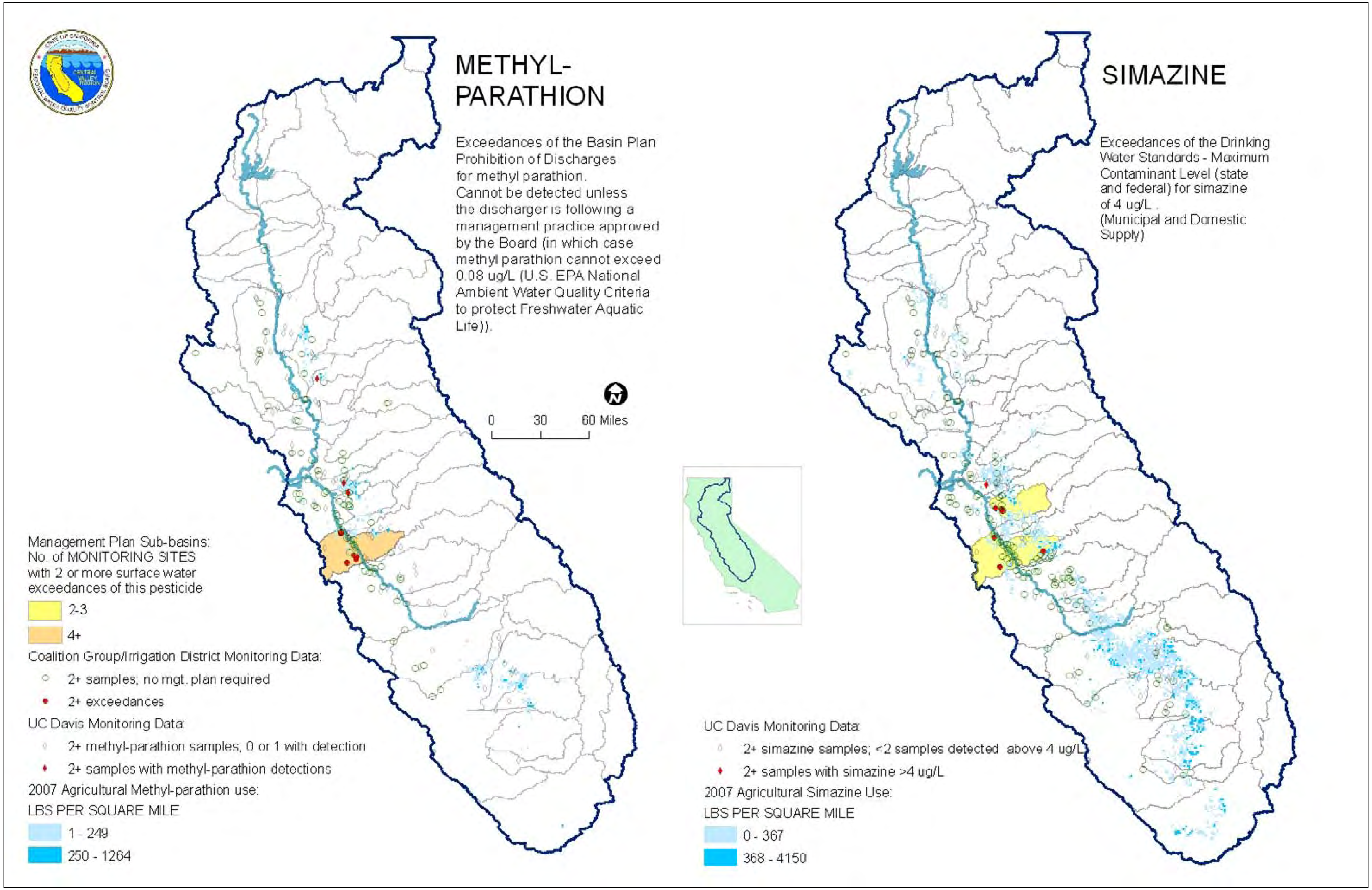

Figure 5.8-8. Methyl-Parathion and Simazine Use, Monitoring Data, and Management Plans

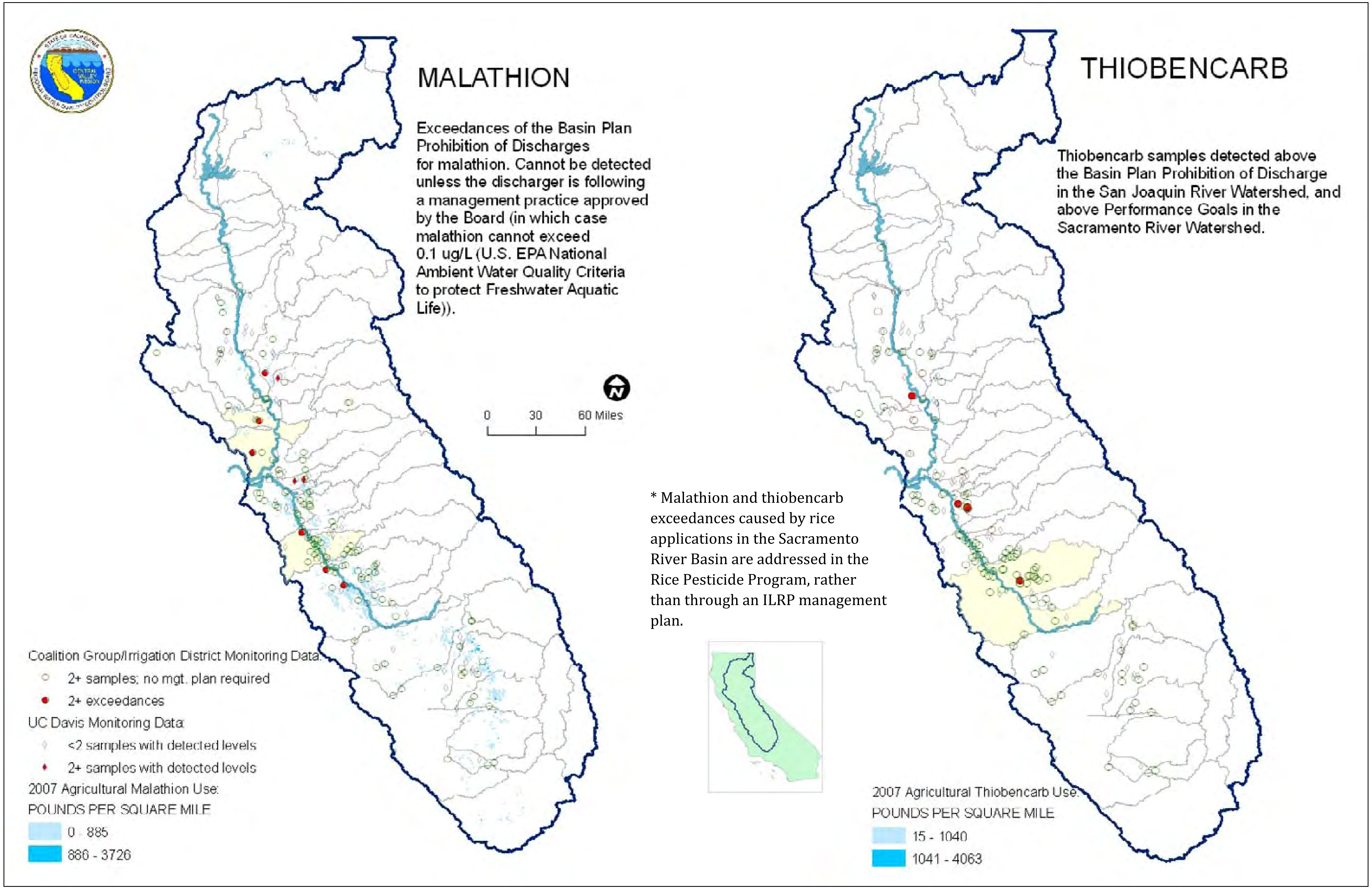

Figure 5.8-9. Malathion and Thiobencarb Use, Monitoring Data, and Management Plans

Table 5.8-6. Overview of Seasonal Inputs of Current-Use Pesticides with Details of Detection, Transport, Fate, and Application

Description	Detection Season	Transport Processes	Major Pesticides of Concern	Persistence in Water	Major Uses	Timing of Application
First flush of dormant-spray insecticides	January–March	Rainfall runoff; atmospheric	Diazonon, methidathion, chlorpyrifos	Moderate	Orchards	December–February
First flush of herbicides	January–March	Rainfall runoff	Simazine	Stable	Orchards, grapes, rights-of-way, landscape	November–February
			Hexazinone	Stable	Alfalfa	December–January
			Diuron	Stable	Alfalfa, rights-of-way	December–February
			DCPA (dacthal)	Stable	Onions, cole crops	January–February
Spring detection of insecticides	March–April	Rainfall runoff; irrigation return flow	Carbofuran	Variable	Alfalfa	March
			Chlorpyrifos	Moderate		
			Malathion	Degrades		
Spring and summer detection of rice pesticides	May–July	Release of rice field water (seepage)	Thiobencarb	Variable	Rice	May–June
Summer detection of other pesticides	June–August	Irrigation return flow	Eptam	Stable	Alfalfa, corn, safflower	May–July
			Metolachlor	Stable	Tomatoes	April–June
			Chlorpyrifos, diazinon	Moderate	Almonds, walnuts	May–August
			Malathion	Degrades		
Urban creeks	Year-round	Rainfall runoff; irrigation return flow	Diazinon, chlorpyrifos	Moderate	Urban use	Year-round
			Carbaryl, malathion	Degrades		

Source: Kuivila and Hladik 2008.

Table 5.8-7. Effects Determinations for Pesticide Active Ingredients on Listed Central Valley Anadromous Salmonids

Pesticide Active Ingredient	Sacramento River Winter-Run Chinook Salmon ESU	Central Valley Spring-Run Chinook Salmon ESU	California Central Valley Steelhead DPS	Source
1,3-Dichloropropene	May affect, but is not likely to adversely affect	No effect	No effect	Daughtry 2004a
2,4-Dichlorophenoxyacetic Acid	May affect (aquatic weed control); may affect, but not likely to adversely affect (rice)	May affect (aquatic weed control); may affect, but not likely to adversely affect (rice)	May affect (aquatic weed control); may affect, but not likely to adversely affect (rice)	Borges et al. 2004
Acephate	No effect	No effect	No effect	Patterson 2004a
Acrolein	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Turner and Erickson 2003
Alachlor	No effect	No effect	No effect	Turner 2002b
Atrazine	No effect	No effect	No effect	Brassard et al. 2003
Azinphos Methyl	May affect	May affect	May affect	Erickson and Turner 2003a
Bensulide	May affect, but not likely to adversely affect	May affect	May affect	Turner 2002a
Bentazon	No effect	No effect	No effect	Turner 2002c
Bromacil and Lithium Bromacil	May affect, but not likely to adversely affect (rights-of-way); no effect (citrus)	May affect, but not likely to adversely affect (rights-of-way); no effect (citrus)	May affect, but not likely to adversely affect (rights-of-way); no effect (citrus)	Turner 2003a
Bromoxynil	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Patterson 2004b
Captan	No effect	No effect	No effect	Patterson 2003c
Carbaryl**	May affect	May affect	May affect	Erickson and Turner 2003b
Carbofuran*	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Tarkowski 2004a
Chlorothalonil	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Turner 2003b
Chlorpyrifos**	May affect	May affect	May affect	Turner 2003c
Coumaphos	No effect	No effect	No effect	Leyhe 2004a
Diazinon*	May affect	May affect	May affect	Turner 2002d
Dicamba	No effect	No effect	No effect	Turner 2003d
Dichlobenil	No effect	No effect	No effect	Stavola and Turner 2003a

Pesticide Active Ingredient	Sacramento River Winter-Run Chinook Salmon ESU	Central Valley Spring-Run Chinook Salmon ESU	California Central Valley Steelhead DPS	Source
Diflubenzuron	No effect	No effect	No effect	Patterson 2004c
Dimethoate	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Patterson 2004d
Disulfoton	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Patterson 2003f
Diuron	May affect (crop finding, if applied above 3.2 pounds of active ingredient per acre); may affect (non-crop finding)	May affect (crop finding, if applied above 3.2 pounds of active ingredient per acre); may affect (non-crop finding)	May affect (crop finding, if applied above 3.2 pounds of active ingredient per acre); may affect (non-crop finding)	Turner 2003e
Ethoprop	No effect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Patterson 2003g
Fenamiphos	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect	Stavola and Turner 2003b
Fenbutatin Oxide	May affect	May affect	May affect	Turner 2002e
Glyphosphate	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Patterson 2004e
Hexazinone	No effect	No effect	No effect	Leyhe 2004b
Iprodione	No effect	No effect	No effect	Turner 2003f
Lindane	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Patterson 2004f
Linuron	No effect	No effect	No effect	Patterson 2004g
Malathion*	May affect (agricultural use); may affect (residential use, including public health and structural pest control uses)	May affect (agricultural use); may affect (residential use, including public health and structural pest control uses)	May affect (agricultural use); may affect (residential use, including public health and structural pest control uses)	Martinez and Leyhe 2004
Methamidophos	No effect	No effect	No effect	Patterson 2004h
Methidathion	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect	Daughtry 2004b
Methomyl*	May affect	May affect	May affect	Erickson and Turner 2003c
Methyl Parathion	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Daughtry and Turner 2004
Metolachlor	No effect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Erickson and Turner 2002c

Pesticide Active Ingredient	Sacramento River Winter-Run Chinook Salmon ESU	Central Valley Spring-Run Chinook Salmon ESU	California Central Valley Steelhead DPS	Source
Metribuzin	No effect	No effect	No effect	Patterson 2004i
Molinate	No effect	No effect	No effect	Turner 2002f
Naled	No effect	No effect	May affect, but not likely to adversely affect	Stavola 2004a
Norflurazon	No effect	No effect	No effect	Turner 2003g
Oryzalin	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Erickson and Turner 2003d
Oxyfluorfen	No effect	No effect	No effect	Daughtry 2004c
Paraquat Dichloride	No effect	No effect	No effect	Turner 2002g
Pebulate	No effect	No effect	No effect	Turner 2002h
Pendimethalin	May affect	May affect	May affect	Pluntke 2004
Phorate	May affect	May affect	May affect	Odenkirchen and Turner 2003
Phosmet	No effect	No effect	No effect	Turner and Mahoney 2003
Prometryn	No effect	No effect	May affect	Erickson and Turner 2002b
Propargite	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Turner 2002i
Simazine	No effect	No effect	No effect	Turner 2003h
Tebuthiuron	No effect	No effect	No effect	Stavola 2004b
Terbacil	No effect	No effect	No effect	Turner 2003i
Thiobencarb	No effect	No effect	No effect	Turner 2002f
Thiodicarb	No effect	No effect	No effect	Turner 2003j
Triclopyr BEE	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect	Tarkowski 2004b
Triclopyr TEA	No effect	No effect	No effect	Turner 2002j
Trifluralin	May affect, but not likely to adversely affect	May affect	May affect	Stavola 2004c

* Draft Biological Opinion has been issued.

** Final Biological Opinion has been issued.

Nutrients and Organics

Nutrients include compounds containing nitrogen or phosphorus. Substances such as ammonia may be directly toxic to fish whereas excess nutrient runoff may trigger blooms of phytoplankton that cause DO depletion following die-off and bacterial decomposition. *Organics* are carbon-containing compounds (dissolved or particulate) such as dead vegetation and manure that also may cause depletion of DO during biological breakdown. Monitoring of DO levels in the program area showed that a considerable number of locations in Zones 2 and 3 (the only zones for which data were summarized) had concentrations below trigger limits: nearly 50 percent (228 of 463) of tests in Zone 2 and 20 percent (225 of 1,145) in Zone 3 (Central Valley Water Board 2007). Trigger limits varied between 5 and 8 mg/l of DO depending on the water body. Examination of DO data for Zone 1 revealed that 71 percent (543 of 761) of tests were below 9.0 mg/l, 39 percent (295 of 761) of tests were below 7.0 mg/l, and 12 percent (88 of 761) of tests were below 5 mg/l. In Zone 4, 46 percent (152 of 329) of tests were below 9.0 mg/l, 14 percent (46 of 329) of tests were below 7.0 mg/l, and 4 percent (14 of 329) of tests were below 5 mg/l. The Pit River (Pit River Subwatershed) is listed as impaired under CWA Section 303(d) for organic enrichment/low DO, which may be a result of agriculture and grazing. High oxygen demand from a variety of sources (possibly including agriculture) has been responsible for low DO in the Stockton Deepwater Ship Channel (Lehman et al. 2004; Central Valley Water Board 2005); DO below 6 mg/l appeared to inhibit upstream migration of Chinook salmon (Hallock et al. 1970). A recent court ruling upheld an amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins that requires studies from entities responsible for oxygen demand in the Stockton Deepwater Ship Channel. The studies will be used to set load and wasteload allocations for DO in the channel (TMDLs) in order to achieve the water quality objectives of 6.0 mg/l in the San Joaquin River (between Turner Cut and Stockton, from September 1 through November 30) and 5.0 mg/l the remainder of the year (Central Valley Water Board 2005).

Trace Elements and Salts

The presence of trace elements in water originating from irrigated lands has the potential to affect fish through chronic or acute mechanisms. For example, tile water (subsurface drain water) may contain elevated concentrations of major ions (such as sodium and sulfate) and of trace elements (such as selenium and boron). Saiki et al. (1992) found that atypical ratios of major cations and ions were probably the cause of toxicity of tile water to juvenile Chinook salmon and striped bass, as opposed to simply elevated concentrations. The role of elevated concentrations of trace elements may have contributed to toxicity in that study, but this was not clear. Toxicity of selenium to juvenile Chinook salmon was shown by Hamilton and Wiedmeyer (1990).

Monitoring of trace elements varied within the program area. In relation to results from Zone 1, the Central Valley Water Board (2007:Z1-18) stated:

> There were several monitoring results for metals, which were not accompanied by hardness data. Hardness provides critical information to be able to evaluate aquatic life protection for some metals. Staff did conduct some review and evaluated the likely hardness value that would be necessary to cause an exceedance in the measured value of metals. In all cases, it would have been unlikely that the water would be sufficiently soft to cause metal toxicity.

Trigger limits for selenium were exceeded in 7 percent (23 of 327) of tests in Zone 1. In Zone 2, trigger limits were not exceeded in any tests (0 of 141) for selenium. Two percent (4 of 182) of tests exceeded selenium trigger limits in Zone 3. Only 23 tests for selenium were conducted in Zone 4, and none exceeded 5 micrograms per liter (μg/l), the trigger limit in other zones.

Increased salt content of water leads to increased conductivity. Conductivity may increase in waters receiving runoff from irrigated lands (Tate et al. 2005). Differences in conductivity have the potential to influence fish assemblage structure (Taylor et al. 1993). EPA (2005) stated in regard to conductivity:

> Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 μmhos/cm. Conductivity outside this range could indicate that the water is not suitable for certain species of fish or macroinvertebrates.

Summaries of conductivity monitoring in the program area were provided only for Zones 2–4 by the Central Valley Water Board (2007), as described by ICF Jones and Stokes (2008). Trigger limits were exceeded in 27 percent (89 of 323) of tests in Zone 2 and in 26 percent (299 of 1145) of tests in Zone 3. Very few measurements were above trigger limits in Zone 4, which the Central Valley Water Board (2007) suggested may have been due to the relatively few monitoring events in Zone 4 compared to other zones. Much monitoring occurred on mainstem rivers with relatively low conductivity, and salinity levels in Zone 3 are relatively low compared to other zones. Note that triggers for conductivity are typically in reference to agricultural use (ICF Jones and Stokes 2008), but they may serve as useful guidelines for freshwater aquatic life, as they are generally 700 μmhos/cm (micromhos per centimeter) or less (Central Valley Water Board 2007). Conductivity data for Zone 1 indicated that 16 percent (109 of 687) of tests were above 700 μS/cm (microsiemens per centimeter), and 29 percent (196 of 687) of tests were above 500 μS/cm. Increases in conductivity are perhaps most relevant to freshwater species with low salinity tolerance. Estuarine species such as delta smelt are more tolerant of a variety of salinities and are found in waters with higher conductivity. For example, the peak occurrence of juvenile delta smelt in summer is at conductivity of 1,000–5,000 μS /cm (Nobriga et al. 2008).

Pathogens

Pathogens are monitored for potential exceedance of trigger limits in relation to human health. Pathogens of concern to fish may affect fish populations in the program area, but data are insufficient to draw any conclusions about existing effects.

Temperature

Streams and other water bodies are often cooler than irrigation return water that they receive (Tate et al. 2005). The temperature differential has the potential to affect fish populations, especially coldwater species such as salmonids. Prioritization of exceedance tracking of other pollutants has not allowed detailed consideration of temperature data in the program area by the Central Valley Water Board, although temperature monitoring is carried out by the grower coalitions. It is anticipated that temperature criteria and subsequent assessment of exceedances will be undertaken as management plans are developed under all ILRP alternatives.

5.8.5 Impacts

This analysis focuses on the effects of the regulatory program on fish at a programmatic level, rather than on the specific effects of management practices used by various growers.

Assessment Methods

The assessment of potential impacts on fish was qualitative by necessity, given the lack of substantial information regarding the extent of environmental changes that may arise from adoption of program alternatives. The basic means of assessment was to consider existing conditions as the baseline and examine proposed changes related to each alternative.

Significance Determinations

The significance determinations for fish are the same as those described in Section 5.7, Vegetation and Wildlife.

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Alternative 1 involves continuing and fully implementing the existing regulatory program. Use of coalition groups as the lead monitoring entities would continue, and third-party entities and growers would implement management practices in response. Under this alternative, management practices would be implemented to reduce the levels of identified constituents of concern below the baseline conditions. Monitoring and management plan requirements of Alternative 1 are expected to result in further implementation of management practices by growers. Although the use of specific management practices is speculative, general effects can be predicted based on the categories of management practices available, including improved water management (erosion and sediment control); nutrient management; tailwater recovery systems; pressurized irrigation; sediment traps, hedgerows, or buffers; and cover cropping or conservation tillage. Implementation of management plans (e.g., for chlorpyrifos, diazinon, and malathion) are expected to result in beneficial impacts. Alternative 1 does not involve any groundwater monitoring or grower site inspections. Management practices currently used to address a constituent could be reduced or discontinued if monitoring shows that a constituent is not of concern.

Impact FISH-1. Improvement to Surface Water Quality in Water Bodies Receiving Inputs from Agricultural Lands and Managed Wetlands

Improvements to surface water quality from implementation of management practices in impaired water bodies receiving inputs from lands in the program area are likely to benefit fish (e.g., by reducing contaminant loads and decreasing sedimentation and total suspended solids). This improvement is a beneficial impact and requires no mitigation.

Impact FISH-2. Temporary Loss or Alteration of Fish Habitat during Construction of Facilities for Management Practices

Construction impacts would result from implementation of management practices that require physical changes to lands in the program area. These physical changes primarily include erosion and sediment controls with features such as construction of water and sediment control basins, temporary water checks, tailwater return systems, vegetated drain systems, windbreaks, and filter strips. Physical changes may be associated with implementation of other management practices, such as construction of filter ditches for pesticide management. Installation of facilities for management practices such as pressurized irrigation and sediment traps is unlikely to significantly exceed the baseline disturbance that occurs during routine field preparation. Construction of features associated with management practices may temporarily reduce the amount or quality of existing fish habitat in certain limited circumstances (e.g., by encroachment onto adjacent water bodies, removal of riparian vegetation, or reduction in water quality—such as increases in sediment runoff during construction). It is difficult to determine whether the management practices selected under Alternative 1 would change relative to existing conditions, and it is not possible to quantify any construction-related effects. Implementation of Alternative 1 may result in effects on fish habitat from construction activities related to management practices. The main management practices and their potential impacts during construction include:

- Nutrient management: no impact (no construction).
- Improved water management: no impact (no construction).
- Tailwater recovery system: potentially significant impact (significant construction).
- Pressurized irrigation: less-than-significant impact (construction effects not likely to significantly exceed impacts associated with baseline field preparation activities).
- Sediment trap, hedgerow, or buffer: less-than-significant impact (construction effects not likely to significantly exceed impacts associated with baseline field preparation activities).

While it is anticipated that the loss of fish habitat resulting from construction activities would be small, if any, data are insufficient to determine how much loss would occur. Consequently, this is considered a potentially significant impact. Implementation of **Mitigation Measure FISH-MM-1** would reduce this impact to a less-than-significant level.

Impact FISH-3. Permanent Loss or Alteration of Fish Habitat during Construction of Facilities for Management Practices

In some cases, permanent loss of fish habitat may occur as a result of construction required for implementation of management practices. Some of the impact may be due to loss of structural habitat (e.g., vegetation) whereas loss of dynamic habitat (e.g., wetted habitat) could be an issue where tailwater augments natural flows or makes seasonal streams into perennial systems. This may be of concern in areas where tailwater return flows are composed mostly of pumped groundwater. Because the extent of the loss is not known, the impact is considered potentially significant. Implementation of **Mitigation Measure FISH-MM-2** would reduce this impact to a less-than-significant level.

Impact FISH-4. Toxicity to Fish or Fish Prey from Particle-Coagulant Water Additives

Polyacrylamides (PAMs) are applied to reduce erosion and sediment runoff and thereby improve water quality (Sojka et al. 2000). Anionic PAMs are safe to aquatic life when used at prescribed rates (Sojka et al. 2000). Because neutral and cationic PAMs may be toxic to fish and their prey (Sojka et al. 2000; Mason et al. 2005), application of anionic PAMs is recommended in areas with sensitive fish species (Mason et al. 2005). This impact is considered potentially significant. Implementation of **Mitigation Measure FISH-MM-2** would reduce this impact to a less-than-significant level.

Alternative 2 – Third-Party Lead Entity

As with Alternative 1, monitoring, tracking, and management plan requirements of Alternative 2 are expected to result in changes in the use of management practices by growers. Under this alternative, management practices would be implemented to reduce the levels of identified constituents of concern below the baseline conditions. As with all alternatives, management practices currently used to address a constituent could be reduced or discontinued if monitoring shows that a constituent is not of concern. These changes in management practices will vary, depending on choices made by individual growers for their crops, locations, and water quality concerns. Although the use of specific management practices is speculative, general effects can be predicted based on the categories of management practices available, including erosion and sediment control, nutrient management, pesticide management, and irrigation water management.

Potential impacts to fish resulting from Alternative 2 would be expected to be similar to those described for Alternative 1; **Impacts FISH-1**, **FISH-2**, **FISH-3**, and **FISH-4** all apply. In addition, wellhead protection activities may occur with associated construction activities.

Impact FISH-5. Temporary Loss or Alteration of Fish Habitat during Wellhead Protection Construction Required by Groundwater Quality Management Plans

As noted above, Alternative 2 would result in similar construction impacts to Alternative 1. However, Alternative 2 would also require management practices to fulfill the requirements of GQMPs. The primary management practice related to groundwater is wellhead protection. The impact associated with this activity is not likely to significantly exceed impacts associated with baseline field preparation activities. Therefore, this impact is considered less than significant, and no mitigation is required.

Alternative 3 – Individual Farm Water Quality Management Plans

Potential impacts on fish under Alternative 3 are generally expected to be as described for Alternative 2. Although uncertain, periodic visual verification of groundwater management practices under Alternative 3 instead of groundwater monitoring required under Alternative 2 may not result in **Impact FISH-1** (improved water quality) achieving the same level of improvement. This is dependent on the extent to which groundwater contributes to surface water quality. Lack of monitoring would not allow the same rigorous assessment of the effectiveness of management practices as should be available under Alternative 2; the opportunity to adaptively manage potential issues presumably would be more difficult without monitoring data. As with all alternatives, management practices currently used to address a constituent could be reduced or discontinued if monitoring shows that a constituent is not of concern.

Alternative 4 – Direct Oversight with Regional Monitoring

Potential impacts on fish under Alternative 4 are expected to be as described for Alternatives 2 and 3. However, given the probability of increased monitoring of individual farms, and especially those at higher risk of generating significant impacts—in addition to wellhead protection, nutrient management plans, tracking of nutrient and pesticide application, and monitoring of individual wells—the positive benefit of **Impact FISH-1** (improved water quality) would probably be greater under Alternative 4 than under Alternative 2 or Alternative 3. As with all alternatives, management practices currently used to address a constituent could be reduced or discontinued if monitoring shows that a constituent is not of concern.

Alternative 5 – Direct Oversight with Farm Monitoring

The potential impacts attributable to management practices under Alternative 5 would be similar to those described for Alternatives 2, 3, and 4. Given the emphasis on monitoring of individual farms, wellhead protection, nutrient management plans, tracking of nutrient and pesticide application, monitoring of individual wells, and potential installation of monitoring wells, the positive benefit of **Impact FISH-1** (improved water quality) probably would be greater under Alternative 5 than under any other alternative. However, installation of the monitoring wells could result in direct impacts on fish habitat adjacent to agricultural lands and managed wetlands. As with all alternatives, management practices currently used to address a constituent could be reduced or discontinued if monitoring shows that a constituent is not of concern.

Impact FISH-6. Temporary Loss or Alteration of Fish Habitat during Construction of Facilities for Management Practices and Groundwater Monitoring Wells

This impact is essentially the same as **Impact FISH-2** except that, in addition to the temporary loss or alteration of habitat due to construction of management practices, further loss or alteration of fish habitat may occur from construction of monitoring wells. Accordingly, the impact is considered potentially significant. Implementation of **Mitigation Measure FISH-MM-1** would reduce this impact to a less-than-significant level.

Impact FISH-7. Permanent Loss or Alteration of Fish Habitat during Construction of Facilities for Management Practices and Groundwater Monitoring Wells

This impact is essentially the same as **Impact FISH-3** except that, in addition to the temporary loss or alteration of habitat due to construction of features associated with management practices, permanent loss or alteration of fish habitat may occur from construction of monitoring wells. Accordingly, the impact is considered potentially significant. Implementation of **Mitigation Measure FISH-MM-2** would reduce this impact to a less-than-significant level.

5.8.6 Mitigation and Improvement Measures

Mitigation Measure FISH-MM-1: Avoid and Minimize Impacts to Fish and Fish Habitat

This mitigation measure incorporates all measures identified in **Mitigation Measure BIO-MM-1**, described in Section 5.7, Vegetation and Wildlife. In each instance where particular management practices could result in impacts to special-status fish species (see "Regulatory Classification of Special-Status Species" in Section 5.8.2), growers should use the least impactful effective management practice to avoid such impacts. Where the ILRP water quality improvement goals cannot be achieved without incurring potential impacts, individual farmers, coalitions, or third-party representatives should implement the following measures to reduce potential impacts to less-than-significant levels. Note that these measures may not be necessary in many cases and are dependent on the location of construction in relation to water bodies containing special-status fish.

- Where construction in areas that may contain special-status fish species cannot be avoided through the use of alternative management practices, conduct an assessment of habitat conditions and the potential for presence of special-status fish species prior to construction;

this may include the hiring of a qualified fisheries biologist to determine the presence of special status fish species;

- Based on the species present in adjacent water bodies and the likely extent of construction work that may affect fish, limit construction to periods that avoid or minimize impacts to special-status fish species.
- Where construction periods cannot be altered to minimize or avoid effects on special-status fish, undertake additional CEQA review and develop a restoration or compensation plan to mitigate the loss of the resources.

Mitigation Measure FISH-MM-2: Educate Growers on the Use of Polyacrylamides for Sediment Control

The Central Valley Water Board will provide information on the potential risks to aquatic life, including special-status fish, that may result from the use of cationic or neutral PAMs during water management activities. Information in the form of leaflets and website information will be provided to grower coalitions, encouraging the use of anionic PAMs. Application of anionic PAMs at prescribed rates will be emphasized in the information provided to growers. Adoption of the USDA National Conservation Practice Standard 450 also will be recommended in the information.

Section 5.9
Hydrology and Water Quality

5.9.1 Introduction

This section describes potential impacts on surface water and groundwater resources associated with the program alternatives. Specifically, it summarizes relevant laws and policies, discusses the existing environmental setting for surface water and groundwater in the program area, and identifies potential impacts on surface water and groundwater that may result from implementation of program alternatives. Mitigation measures to avoid or reduce potentially significant impacts also are presented.

The Central Valley watershed is divided into three major hydrologic regions (Figure 5.9-1) or surface water basins:

- The Sacramento River Basin contains the entire drainage area of the Sacramento River and its tributaries. It begins upstream of Shasta Lake near the Oregon border and extends south to the Delta, stretching roughly from the northeast corner of California to Sacramento County.
- The San Joaquin River Basin contains the entire drainage area of the San Joaquin River and its tributaries. It extends from the Delta and the Cosumnes River in the north to the southern reaches of the San Joaquin River watershed, encompassing the area from Sacramento County (including the southeast corner of the county itself) to Madera County (and portions of Fresno County).
- The Tulare Lake Basin includes the Southern San Joaquin Valley. It ranges from the southern limit of the San Joaquin River watershed to the crest of the Tehachapi Mountains.

Each of the three major surface water basins is divided into subwatersheds delineated by DWR CalWater boundaries. The ECR discusses the three basins and their 30 associated subwatersheds, and provides all methods used to assess the surface water conditions of the basins. The reader is referred to this document for additional detail.

The groundwater basins and subbasins that exist in the Central Valley watershed have been delineated using the boundaries in Bulletin 118 (DWR 2003). Figures 5.9-2 through 5.9-4 map the boundaries of these basins. Although the groundwater basin boundaries do not coincide exactly with surface water basin boundaries, DWR reports groundwater information separately for the Sacramento River, San Joaquin River, and Tulare Lake Basins. The Sacramento River Basin consists of 90 groundwater basins and subbasins, the San Joaquin River Basin includes 9 groundwater subbasins, and the Tulare Lake Basin includes 19 groundwater basins and subbasins. The ECR discusses the 118 basins and subbasins in detail, and focuses on the occurrence of groundwater contamination due to irrigated agriculture. The reader is referred to this document for additional detail.

5.9.2 Regulatory Framework

The following federal and state regulations are relevant to surface water and groundwater resources in the program area.

Federal

Clean Water Act

The State Water Board is the state agency with primary responsibility for implementing the CWA which establishes regulations relating to water resource issues. Typically, all regulatory requirements are implemented by the State Water Board through nine Regional Water Boards established throughout the state. The Central Valley Water Board is responsible for regulating waste discharges to Central Valley waters protected under the CWA.

The CWA is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. It operates on the principle that all discharges into the nation's waters, unless exempted, are unlawful unless specifically authorized by a permit. Permit review is the CWA's primary regulatory tool. Section 402(l)(1) of the CWA exempts the discharge of return flows from irrigated agriculture from this permit requirement. The following sections provide additional details on specific sections of the CWA.

Permits for Stormwater Discharge

CWA Section 402 regulates construction-related stormwater discharges to surface waters through the National Pollution Discharge Elimination System (NPDES) program, administered by EPA. In California, the State Water Board is authorized by EPA to oversee the NPDES program through the Regional Water Boards (see "Porter-Cologne Water Quality Control Act" below). The NPDES program provides for both general permits (which cover a number of similar or related activities) and individual permits.

General Construction Permit

Most construction projects that disturb 1 acre of land or more are required to obtain coverage under the NPDES General Permit for Construction Activities (General Construction Permit), which requires the applicant to file a public notice of intent to discharge stormwater and to prepare and implement a stormwater pollution prevention plan (SWPPP). The SWPPP includes a site map, description of proposed construction activities, demonstration of compliance with relevant local ordinances and regulations, and overview of the BMPs that will be implemented to prevent soil erosion and discharge of other construction-related pollutants that could contaminate nearby water resources. Permittees are required to conduct annual monitoring and reporting to ensure that BMPs are correctly implemented and are effective in controlling the discharge of stormwater-related pollutants.

National Toxics Rule (40 CFR Part 131.36)

The National Toxics Rule is EPA's rule promulgating the numeric water quality criteria necessary to bring all states into compliance with the CWA. The National Toxics Rule applies to the 14 states and territories that were without EPA-approved criteria when the final rule was published (Alaska, Arkansas, California, Florida, Idaho, Kansas, Michigan, Nevada, New Jersey, Rhode Island, Vermont, Washington, District of Columbia, and Puerto Rico). For these states and territories, the criteria in the National Toxics Rule are the legally enforceable standards for all purposes and programs under the CWA.

California Toxics Rule (40 CFR Part 131.38)

EPA's California Toxics Rule promulgates numeric water quality criteria for more than 126 priority pollutants. The numeric criteria in the California Toxics Rule must be achieved in the surface waters of the state with relevant beneficial uses (e.g., municipal supply, aquatic life). If these objectives are not met within a water of the state with a designated beneficial use, the water body would be listed as impaired.

Federal Antidegradation Policy

Federal water quality regulation contains an antidegradation policy and a requirement that states develop a similar policy (40 CFR Section 131.12). This regulation establishes a three-part test to determine whether increases in pollutant loading or adverse changes in the quality of federal surface water may be permitted. The three tests are described in the policy transcribed below:

Section 131.12 Antidegradation Policy

(a) The State shall develop and adopt a statewide antidegradation policy and identify the methods for implementing such policy pursuant to this subpart. The antidegradation policy and implementation methods shall, at a minimum, be consistent with the following:

(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.

(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

(4) In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act.

The state antidegradation policy described below complies with this requirement and incorporates the federal policy by reference.

State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act established the State Water Board and divided the state into nine regions, each overseen by a Regional Water Board. The State Water Board is the primary state agency responsible for protecting the quality of the state's surface water and groundwater supplies, although much of its daily implementation authority is delegated to the Regional Water Boards, which are responsible for implementing CWA Sections 402 and 303(d). In general, the State Water Board manages both water rights and statewide regulation of water quality, while the Regional Water Boards focus exclusively on water quality within their regions.

California Regional Water Quality Control Board, Central Valley Region

The Central Valley Water Board is responsible for implementing Basin Plans for the Sacramento and San Joaquin River Basins and the Tulare Lake Basin. A Basin Plan identifies beneficial uses of surface water and groundwater as well as water quality objectives to protect those uses. Numerical and narrative criteria are contained in Basin Plans for several key water quality constituents, including DO, water temperature, trace metals, turbidity, suspended material, pesticides, salinity, radioactivity, and other related constituents.

The methods the Central Valley Water Board uses to implement Basin Plan criteria include issuing WDRs. WDRs may be issued to any entity that discharges waste that may affect the quality of any Central Valley surface water or groundwater. For discharges to waters protected under the CWA, WDRs also could serve as a federally required NPDES permit (under the CWA) and incorporate the requirements of other applicable regulations.

The Water Code authorizes State and Regional Water Boards to conditionally waive WDRs if this is in the public interest. Over the years, the Regional Water Boards have issued waivers for over 40 categories of discharges. Although waivers are always conditional, the historical waivers had few conditions. In general, they required that discharges not cause violations of water quality objectives but did not require water quality monitoring. SB 390, signed into law on October 6, 1999, required the Regional Water Boards to review their existing waivers and to renew them or replace them with WDRs. Under SB 390, waivers not reissued automatically expired on January 1, 2003. To comply with SB 390, the Regional Water Boards adopted revised waivers. The most controversial waivers were those for discharges from irrigated agriculture. Discharges from agricultural lands include irrigation return flow, flows from tile drains, and storm water runoff. As a control mechanism, development of a "conditional prohibition," as allowed by a Basin Plan, is an innovative and proven successful approach for controlling discharges.

Basin Plans and Water Quality Objectives

The Porter-Cologne Act provides for development and periodic review of Basin Plans that designate beneficial uses of California's major rivers and groundwater basins, and establish narrative and numerical water quality objectives for those waters. Beneficial uses represent the services and qualities of a water body (i.e., the reasons the water body is considered valuable), while water quality objectives represent the standards necessary to protect and support those beneficial uses. Basin Plans are primarily implemented through development of WDRs, waivers of WDRs, and NPDES permits to regulate waste discharges so that water quality objectives are met. NPDES permits do not apply to agricultural return flows. Basin Plans are required to be reviewed every 3 years and provide the regulatory basis for determining WDRs and waivers of WDRs.

Water Quality Objectives by Region

The Regional Water Boards have set water quality objectives for all groundwater and surface waters in their respective regions for the following substances and parameters: ammonia, bacteria, biostimulatory substances, chemical constituents, color, DO, floating material, oil and grease, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity. Basin Plans also include the following narrative water quality objectives: "bacteria, chemical constituents, taste/odor and toxicity". Where there is a waste discharge of a substance that does not currently have specified numeric objectives in a Basin Plan, the Central Valley Water Board may use the narrative objective to determine appropriate objectives for such wastes (examples include pesticides).

State Antidegradation Policy

A key policy of California's water quality program is the Antidegradation Policy. This policy, formally known as the *Statement of Policy with Respect to Maintaining High Quality Waters in California* (State Water Board Resolution No. 68-16), restricts degradation of surface water and groundwater. In particular, this policy protects water bodies where existing quality is higher than necessary for the protection of beneficial uses. Under the Antidegradation Policy, any actions that can adversely affect water quality in surface water and groundwater must (1) be consistent with maximum benefit to the people of the State; (2) not unreasonably affect present and anticipated beneficial use of the water; and (3) not result in water quality less than that prescribed in water quality plans and policies. The policy also requires that waste discharges to high-quality waters meet WDRs that result in best practicable treatment or control of the discharge and ensure that avoidance of pollution or nuisance and highest water quality consistent with maximum benefit to the people of the State be maintained (State Water Board 1968).

5.9.3 Environmental Setting

The ILRP program area extends from the northeast corner of California to the southern part of the Central Valley. The environmental setting summarizes the information found in the ECR for the three major hydrologic basins.

Sacramento River Basin

Regional Hydrology

The Sacramento River Basin contains the entire drainage area of the Sacramento River and its tributaries, from the northeast corner of California to Sacramento County (Figure 5.9-5). The basin drains approximately one-third of total runoff in the state into the middle and lower reaches of the Sacramento River.

Land uses in the Sacramento River Basin are principally forest and range lands in the upper reaches, with urban development focused around the City of Sacramento. Agriculture is the dominant land use on the valley floor, followed by urban development.

The Sacramento River Basin encompasses approximately 12.2 million acres. Of this amount, 2.4 million acres are classified as agricultural lands. The majority of the irrigated agricultural acres occur on the Valley floor, in the Solano-Yolo, Colusa Basin, and Butte-Sutter-Yuba Subwatersheds. Rice is the primary crop in the Sacramento River Basin, particularly in the Colusa and Butte-Sutter-Yuba Subwatersheds where poorly drained soils provide ideal conditions for this crop. Other predominant crop types include field crops, orchards, pasture, and grains.

Agricultural land uses account for less than 10 percent of total acreage in the Pit River, Shasta-Tehama, Upper Feather River–Upper Yuba River, American River, and Lake-Napa Subwatersheds.

The eight subwatersheds and the 90 groundwater basins and subbasins in the Sacramento River Basin are described in detail in the ECR.

Surface Water Quality

In general, agricultural operations have a greater impact on surface water in the Central Valley area around the Sacramento River than in the higher surrounding elevations of the Coast and Cascade Ranges and Sierra Nevada. This is primarily due to the valley topography allowing for much larger agricultural operations. Figure 5.9-6 is a conceptual surface water model that depicts various agricultural operations and use of surface water. Source water from rivers is used in agricultural operations, and agricultural return flows often are conveyed back to the river carrying agricultural-related contaminants.

The ECR identifies the known agricultural contaminants and conditions that affect surface water quality in the Sacramento River Basin. These include pesticides such as diazinon, chlorpyrifos, Azimphos-methyl, carbofuran, Group A pesticides, methyl parathion, and molinate/ordram. Toxicity, and bacteria are also known water quality problems in the Sacrament River Basin.

Water quality concerns in the Sacramento River Basin are concentrated in the Sacramento Valley, in subwatersheds that are heavily dominated by agriculture. These include the Butte-Sutter-Yuba, Colusa Basin, and Solano-Yolo Subwatersheds (see Figures 5.9-7 through 5.9-9) where agricultural land uses constitute 36, 37, and 60 percent of total acreage, respectively. Areas of water quality impairment, as indicated by two or more water quality exceedances, are mapped in Figures 5.9-7 through 5.9-9. Section 303(d) listings related to irrigated agriculture occur in all of these subwatersheds, as well as in the American River Subwatershed.

Groundwater Quality

Detailed information in the ECR focuses on the occurrence of groundwater contamination due to irrigated agriculture in the Sacramento River Basin. Twenty-five percent of the basins or subbasins have insufficient data or available data indicate no groundwater quality problems. In a large number of the basins or subbasins (30 percent), irrigated agriculture occupies 5 percent or less of the area. The ECR also provides the results of monitoring performed as part of the DPR Ground Water Protection Program. The DPR Ground Water Protection Program monitors pesticides in groundwater. Monitoring from 1985 to 2003 revealed that Butte, Colusa, Glenn, Placer, Sacramento, Shasta, Solano, Sutter, Tehama, Yolo, and Yuba Counties contained one or more pesticide detections in groundwater. However, most of these counties showed only minimal detection of pesticides. Glenn, Colusa, Solano, and Butte Counties had the greatest detection of pesticides (see the ECR). Results of the DPR monitoring program for the Sacramento River Basin are summarized in Table 5.9-1.

Table 5.9-1. Pesticide Detections in Groundwater Wells for Counties in the Sacramento River Basin (1985–2003)

County	ACET	Atrazine	Bentazon	Bromocitl	DACT	DEA	Diuron	Norflurazon	Promoton	Simizine
Butte		6	8	1		1	1	2	1	1
Colusa	2		7			1			1	4
Glenn		23	21			4	2		5	11
Placer			1	1						
Sacramento		1	1							
Shasta	1				1					
Solano	6	13			3	9	4	1	1	1
Sutter			5							2
Tehama	1	3				2	1			2
Yolo		5	3							3
Yuba			8							
Total	**10**	**51**	**54**	**2**	**4**	**17**	**8**	**3**	**8**	**24**

Notes:
ACET = 2-amino-4-chloro-6-ethylamino-s-triazine.
DACT = 2,4-diamino-6-chloro-s-triazine.
DEA = deethyl-atrazine.
Source: DPR 2003.

Figure 5.9-17 shows areas throughout California with elevated levels of nitrate in groundwater, including areas within the Sacramento River Basin.

San Joaquin River Basin

Regional Hydrology

The San Joaquin River Basin drains a region that extends across the Central Valley to the Coast Ranges, between the Cosumnes River to the north and the San Joaquin River to the south (Figure 5.9-10).

The San Joaquin River Basin encompasses approximately 9.8 million acres. In general, above the valley floor, the basin is dominated by native vegetation. The primary tributaries in the basin are the Stanislaus River, Tuolumne River, and Merced River, which meet with the San Joaquin River in the Valley floor. The basin is dominated by agriculture at the confluence of the San Joaquin and these various rivers. The San Joaquin River Basin includes most of the Delta as well as the Delta-Mendota Canal, a highly manipulated component of the Central Valley Project. Multiple canals in the Delta-Mendota Canal Subwatershed deliver water to agricultural operations and then back to the natural drainages. Many tributaries in the subwatershed that would otherwise be dry during the summer irrigation season flow year-round due to agricultural return flows.

Approximately 2 million acres within the basin are classified as agricultural. Agricultural land uses in the basin are concentrated in the Valley floor—specifically in the Delta-Mendota Canal, San Joaquin Valley Floor, Delta-Carbona, and North Valley Floor Subwatersheds. There is very little agriculture in the remaining subwatersheds, less than 1 percent in most cases. The primary crops that are produced in the San Joaquin River Basin include field crops, pasture, deciduous fruits and nut orchards, vineyards, grain and hay.

The 12 subwatersheds and nine groundwater subbasins in the San Joaquin River Basin are described in detail in the ECR.

Surface Water Quality

In general, agricultural operations have a greater impact on surface water in the Central Valley area around the San Joaquin River than in the higher surrounding elevations of the Coast Ranges and Sierra Nevada. This is primarily due to the valley topography allowing for much larger agricultural operations.

The water quality of the San Joaquin River is of critical interest because it flows to the South Delta area, which is a primary source of drinking water, and supplies irrigation water to farms in the western San Joaquin Valley. Water quality concerns in the San Joaquin River Basin relate to the (1) transport of pesticides by agricultural return flows to water bodies; and (2) transport of pesticides that are applied to orchards during the dormant growing season (November to January) and are transported to water bodies during rainfall events. In addition to pesticides, other nutrient-related water quality concerns are associated with irrigated agriculture.

Water quality concerns in the San Joaquin River Basin are concentrated in the subwatersheds that are heavily agricultural—specifically, the Delta-Mendota Canal, San Joaquin Valley Floor, Delta-Carbona, and North Valley Floor Subwatersheds (see Figures 5.9-11 through 5.9-14). Agricultural land constitutes one-third to one-half of the total land use in each of these subwatersheds. Correspondingly, all of these subwatersheds include water bodies impaired by Section 303(d)-listed pollutants that are associated with irrigated agriculture.

Water quality impairments in San Joaquin River Basin surface water are mapped in Figures 5.9-11 through 5.9-14. Many of the rivers, creeks, and agricultural drainages that are dominated by agricultural return flows contain low DO (generally associated with agricultural return flows), fluctuating pH, and elevated levels of EC (indicative of high salinity). Within each watershed, data indicate that chlorpyrifos, diazinon, permethrin, dieldrin, and DDT (and its breakdown products DDD and DDE) are frequently present in concentrations that exceed water quality objectives. Other pesticides are detected in these subwatersheds but not consistently in each subwatershed. These constituents include azinphos-methyl, carbofuran, cyhalthrin, cypermethrin, demeton, dieldrin, dimethoate, disulfoton, diuron, endrin, esfenvalerate/fenvalerate, linuron, malathion, methyl, methyl parathion, methomyl, simazine, thiobencarb, parathion, permethrin-1, permethrin-2, and total permethrin. In addition, elevated levels of naturally occurring metals that are mobilized and suspended in agricultural return flows are common in these subwatersheds—such as copper, arsenic, cadmium, boron, nickel, lead, and selenium.

Groundwater Quality

Most of the groundwater quality summary information for the San Joaquin River Basin presented in the ECR is reported as part of a discussion of the entire San Joaquin Valley Groundwater Basin, which also includes the Tulare Lake Basin. The more detailed information is presented as discussions of each subbasin within the San Joaquin River Basin. The reader is referred to the ECR for this more detailed information.

Groundwater subbasins underlay approximately 3.73 million acres of the 9.8-million-acre San Joaquin River Basin. Most of these subbasins underlay the San Joaquin Valley floor. Groundwater is extensively used by agricultural and urban entities in this area. Approximately 30 percent of agricultural and urban water use comes from pumping groundwater. (DWR 2003.)

The National Water Quality Assessment (NAWQA) for the San Joaquin Valley Groundwater Basin concluded that groundwater within the eastern portion of the San Joaquin Valley that supplies drinking water to the majority of the population has been degraded by fertilizers and pesticides (Dubrovsky et al. 1998). This report concluded that nitrate concentrations frequently exceeded drinking water standards while pesticides, with the exception of DBCP, rarely exceeded drinking water standards. The specific conclusions are identified in the ECR.

The ECR also provides the results of monitoring that was performed as part of the DPR Ground Water Protection Program and the USGS GAMA Program. The ECR identified pesticide detections by counties and presented the data in table format. Within the San Joaquin River Basin, San Joaquin, Stanislaus, Merced and Madera Counties were the large contributors to pesticide detection in groundwater (ECR 2008). Results from monitoring that was performed as part of the DPR Ground Water Protection Program are summarized in Table 5.9-2.

Table 5.9-2. Pesticide Detections in Groundwater Wells for Counties in the San Joaquin River Basin (1985–2003)

County	ACET	Atrazine	Bentazon	Bromocitl	DACT	DEA	Diuron	Norflurazon	Promoton	Simizine
Amador										
Calaveras										
Contra Costa		1		1			1		2	1
Mariposa										
Madera	4	2		2	3	2	6			4
Merced	8	4	1	3	8	2	7	1	1	6
San Joaquin	19	7		5	15	10	7	1		7
Stanislaus	5	4	3	1	2	1	7		1	11
Tuolumne										
Total	**36**	**18**	**4**	**12**	**28**	**15**	**28**	**2**	**4**	**30**

Notes:
ACET = 2-amino-4-chloro-6-ethylamino-s-triazine.
DACT = 2,4-diamino-6-chloro-s-triazine.
DEA = deethyl-atrazine.
Source: DPR 2003.

As indicated in Figure 5.9-17, high nitrate concentrations are found in groundwater throughout the valley, with high concentrations reported in the San Joaquin River Basin in Merced, Stanislaus, and San Joaquin Counties.

Tulare Lake Basin

Regional Hydrology

The Tulare Lake Basin encompasses a drainage area from Fresno to the southern end of the Central Valley near the Grapevine and is essentially a closed basin (Figure 5.9-15).

The Tulare Lake Basin encompasses approximately 10.7 million acres. Of this amount, 3.6 million acres are classified as agricultural. The vast majority of this agricultural land is located in the South Valley Floor Subwatershed (3.5 million acres). In comparison with other subwatersheds in the Tulare Lake Basin, the South Valley Floor Subwatershed is relatively flat. Consequently, the bulk of water quality concerns related to the Tulare Lake Basin involve agricultural operations and agricultural return flows in the South Valley Floor Subwatershed.

Due to the amount of land in the Tulare Lake Basin that is in the Sierra Nevada and the Coast Ranges, most of the basin is dominated by native vegetation and includes little urban development. In the upper watershed areas, irrigated agriculture accounts for less than 2 percent of land uses (Kings River, Kaweah River, Kern River, Grapevine, Coast Range, Sunflower Valley, and Southern Sierra Subwatersheds) with just slightly more in the Temblor Subwatershed (3.3 percent). There is no agriculture in the Fellows Subwatershed. The primary crop types within the Tulare Lake Basin are grain and hay crops, pasture, and deciduous fruits and nuts. The primary crop types within the South Valley Floor Subwatershed are field crops, followed by deciduous fruits and nuts, vineyards, pasture, and grain and hay.

The 10 subwatersheds and the 19 groundwater basins and subbasins in the Tulare Lake Basin are described in detail in the ECR.

Surface Water Quality

In general, agricultural operations have a greater impact on surface water in the Central Valley between the Fresno area and the Tehachapi Mountains than other parts of the Valley. This is primarily due to the valley topography allowing for much larger agricultural operations.

Section 303(d) water quality concerns within the Tulare Lake Basin are limited to the South Valley Floor Subwatershed. None of the other subwatersheds include water bodies with Section 303(d)-listed pollutants; physical parameters such as EC, pH, temperature, and turbidity are generally within Basin Plan standards. Constituents such as selenium and sedimentation are believed to be naturally occurring (with the exception of the South Valley Floor Subwatershed).

The South Valley Floor Subwatershed is the largest subwatershed within the Tulare Lake Basin, at approximately 5.3 million acres (approximately 8,280 square miles). The subwatershed is located in the southern Central Valley and is bounded to the north by the San Joaquin River, to the south by the Tehachapi Mountains, on the west by the Coast Ranges, and on the east by the Sierra Nevada. As noted, the South Valley Floor Subwatershed is relatively flat compared to the surrounding subwatersheds. Agriculture is the primary land use type in the subwatershed, encompassing approximately 66 percent (3.5 million acres) of the total land area.

Surface water runoff in the South Valley Floor Subwatershed is not sufficient to support existing land uses in the subwatershed, resulting in a large proportion of water being imported from other locations. The Friant-Kern Canal, the San Luis Canal/California Aqueduct System, and the Cross-

Valley Canal are major water delivery facilities that have dramatically altered the way water is managed in the South Valley Floor Subwatershed; water is moved from one end of the valley to the other as needed. Because of the intensive water development that has occurred in the subwatershed, very few channels are not specifically maintained as water delivery features and there is very little monitoring or characterization of the subwatershed's water quality.

During the irrigation season, water bodies in the South Valley Floor Subwatershed are dominated by agricultural return flows, which may transport pesticides to the various east side and west side drainages. In addition, pesticides that are applied during the dormant spray season, which typically occurs between November and January, can be transported from fields during rainfall events. Data indicate that chlorpyrifos, azinphos-methyl, dimethoate, malathion, thiobencarb, esfenvalerate, cypermethrin, toxaphene, DDE, DDT, and DDD are present in concentrations that exceed water quality objectives (Figure 5.9-16 shows areas that experience two or more exceedances for each respective water quality constituent). Copper also has been detected at multiple locations in the South Valley Floor Subwatershed. Copper is a naturally occurring metal that also is used as a pesticide. Other metals such as arsenic, cadmium, boron, lead, molybdenum, manganese, zinc, iron, and selenium have been detected at elevated levels and are likely mobilized by agricultural return flows.

Many of the creeks and drainages located in the South Valley Floor Subwatershed contain low DO. Factors contributing to low DO are currently under investigation but are possibly associated with nutrient loads from irrigated agriculture. In addition, many of the creeks in the subwatershed experience fluctuating levels of pH and elevated levels of EC. Toxicity tests indicate that non-polar organics are causing toxicity problems in the South Valley Floor Subwatershed. Non-polar organics, including chlorpyrifos, diazinon, dimethoate, disulfton, diuron, cyfluthrin, dioxathion, simazine, and atrazine, were found in some of the samples tested and were identified as likely or potential causes of observed toxicity.

Groundwater Quality

The Tulare Lake Basin consists of seven groundwater subbasins in the valley floor and 12 smaller basins in the surrounding mountain areas (Figure 5.9-4). As with the San Joaquin River Basin, most of the groundwater quality summary information for the Tulare Lake Basin presented in the ECR is reported as part of a discussion of the entire San Joaquin Valley Groundwater Basin. The more detailed information is presented as discussions of each basin and subbasin. The reader is referred to the ECR for this more detailed information.

The NAWQA for the San Joaquin Valley Groundwater Basin concluded that groundwater within the eastern portion of the San Joaquin Valley (including the eastern side of the Tulare Lake Basin) that supplies drinking water to the majority of the population has been degraded by fertilizers and pesticides (Dubrovsky et al. 1998). This report concluded that nitrate concentrations frequently exceeded drinking water standards while pesticides, with the exception of DBCP, rarely exceeded drinking water standards. The specific conclusions are identified in the ECR.

The ECR also provides the results of monitoring that was performed as part of the DPR Ground Water Protection Program and the USGS GAMA Program. Results from DPR monitoring in the Tulare Lake Basin are summarized in Table 5.9-3. The most numerous detections were reported from Fresno and Tulare Counties.

Table 5.9-3. Pesticide Detections in Groundwater Wells for Counties in the Tulare Lake Basin (1985–2003)

County	ACET	Atrazine	Bentazon	Bromocitl	DACT	DEA	Diuron	Norflurazon	Promoton	Simizine
Fresno	121	10		54	70	7	107	21	4	180
Kings		1					3		1	
Kern	4	3		4	1	2	12			2
Tulare	70	24		145	30	10	250	14	8	282
Total	**195**	**38**		**203**	**101**	**19**	**372**	**35**	**13**	**464**

Notes:
ACET = 2-amino-4-chloro-6-ethylamino-s-triazine.
DACT = 2,4-diamino-6-chloro-s-triazine.
DEA = deethyl-atrazine.
Source: DPR 2003.

High nitrate concentrations are found in groundwater throughout the valley portion of the Tulare Lake Basin (see Figure 5.9-17), with the highest concentrations reported in western Tulare and Kern Counties.

5.9.4 Impacts

This analysis focuses on the effects of the regulatory program on hydrology and water quality at a programmatic level, rather than on the specific effects of management practices used by various growers.

Assessment Methods and Data Collection

Collection of resources and data for surface water quality and groundwater quality was accomplished using various state and federal agency websites, and water quality reports from various water quality coalitions. USGS and the Central Valley Water Board conducted many critical water quality studies over the years that play an important role in the data collected for this report. The following key references were used to compile this section:

- California Department of Water Resources. 2003. *California's Groundwater: Bulletin 118 – Update 2003.* Sacramento, CA.
- Central Valley Regional Water Quality Control Board. 2007a. Revised Draft of the 2007 Review of Monitoring Data for the Irrigated Lands Conditional Waiver Program. July.
- Kratzer, Charles, Celia Zamora, and Donna Knifong. 2002. Diazinon and Chlorpyrifos Loads in the San Joaquin River Basin, California, January and February 2000. (USGS Water Resources Investigations Report 02-4103.)
- Kratzer, Charles, Peter Dileanis, Celia Zamora, Steven Silva, Carol Kendall, Brian Bergamazchi, and Randy Dalhgren. 2004. Sources and Transport of Nutrients, Organic Carbon, and Chlorophylle-a in the San Joaquin River Upstream of Vernalis, California, during Summer and Fall 2000 and 2001. Available: <http://pubs.usgs.gov/wri/wri034127/wri034127rev.pdf>. Accessed: June 12, 2008.

- Schuette, J., D. Weaver, J. Troiano, M. Pepple, and J. Dias. 2003. Sampling for Pesticide Residues in California Water Wells: 2003 Well Inventory Database, Cumulative Report 1986–2003. (California Department of Pesticide Regulation Document EH03-08.) December.
- U.S. Geological Survey. 2005b. National Water-Quality Assessment Program. San Joaquin–Tulare Basins NAWQA. Available: <http://ca.water.usgs.gov/sanj/sanj.html> Accessed: October 13, 2005.
- U.S. Geological Survey. 2005c. Water Quality Database. Available: <http://nwis.waterdata.usgs.gov/usa/nwis/qwdata>.
- Weston D. P., J. You, E. L Amweg, and M. J. Lydy. (In Press.) Sediment Toxicity in Agricultural Areas of California and the Role of Hydrophobic Pesticides. In J. Gan, F. Spurlock, P. Hendley, and D. Weston (eds.), Synthetic Pyrethroids: Occurance and Behavior in Aquatic Environments. American Chemical Society, Washington, DC.
- Zamora, Celia, Charles Kratzer, Michael Majewski, and Donna Knifong. 2003. Diazinon and Chlorpyrifos Loads in Precipitation and Urban and Agricultural Storm Runoff during January and February 2001 in the San Joaquin River Basin, California. (U.S. Geological Survey Water Resources Investigations Report 03-4091.)

The significance of an impact associated with the program alternatives was determined using professional judgment and collected data, as applied to the significance determinations described below. The key effects were identified and evaluated based on the physical characteristics of the program area and the magnitude, intensity, and duration of the farm management activities expected to be implemented as a result of the regulatory program. Program alternatives are evaluated below in the impact analysis. The baseline description is included in Chapter 4 and earlier in this chapter.

The changes in farm management practices that are anticipated to occur following implementation of the regulatory program alternatives are identified in Table 5.1-1 at the beginning of this chapter and are described in more detail in the ECR. Some or all of these practices are expected to be undertaken in parts of the program area with surface water quality impairments or groundwater quality exceedances associated with agriculture, as described in the ECR and in Chapter 4. Other management practices also may be undertaken, but those listed below were used to form the impact analyses. Specific actions and their potential effects are included in the alternative-specific impact discussions. These actions include the following:

- Nutrient management;
- Improved water management;
- Tailwater recovery systems;
- Pressurized irrigation;
- Sediment trap, hedgerow, or buffer;
- Cover cropping or conservation tillage; and
- Wellhead protection.

Significance Determinations

For this analysis, an impact pertaining to hydrology and water quality was considered significant under CEQA if it would result in either of the following environmental effects, which are based primarily on professional practice and State CEQA Guidelines Appendix G (14 CCR 15000 et seq.):

- Contribute to degradation of state waters as a result of agricultural discharge, or
- Substantially alter hydrologic patterns of runoff or infiltration.

Other related similar CEQA thresholds of significance that are included in Appendix G of the State CEQA Guidelines, such as thresholds related to flooding, do not apply to this program and thus are not discussed further.

Alternative 1 –Full Implementation of Current Program (No Project Alternative)

Impact HYD-1. Change in Quality of State Waters from Agricultural Discharge or Alteration of Hydrologic Patterns of Runoff or Infiltration

Alternative 1 involves full implementation of the existing regulatory program. As such, it is similar to baseline conditions, except for additional management practices that would be implemented as a result of monitoring feedback and continuing implementation of management plans. Use of coalition groups as the lead monitoring entities would continue, and third-party entities and growers would implement management practices in response. It is expected that existing water quality conditions, such as the surface water quality impairments detailed in the environmental setting section above and in the ECR, would improve over time as the program would continue to implement surface water management practices and management plans. However, Alternative 1 does not involve implementing any GQMPs to protect groundwater quality from agricultural practices. As a result, the wellhead protection management practice would not apply to this alternative.

Under Alternative 1, growers would implement surface water management practices in response to water quality monitoring results. The practices are listed above (see "Assessment Methods and Data Collection") and are described in detail in Table 5.1-1. Not all watersheds would implement all of these management practices, as the management practices depend on the needs of the individual watershed. In the case of watersheds that are impaired by irrigated agriculture, all of these management practices may be used on a case-by-case basis to improve water quality.

Nutrient management would improve both surface water quality and groundwater quality by improving the use of chemicals and using improved application techniques, and by limiting the use of nutrients as fertilizer that could potentially seep to groundwater and add nitrate to the groundwater table. Overall, nutrient management would reduce both soluble and insoluble constituents moving to water bodies. Improved water management also would benefit water quality by improving the application of water, and the possibility of using water additives to coagulate particles would reduce the potential sediment loads to water bodies. Pressurized irrigation is somewhat homogenous with the water management practice and would improve groundwater quality and surface water quality. Water would be applied at a rate that would allow for maximum plant consumption and would minimize the amount of groundwater infiltration, which would improve groundwater quality over time.

Tailwater recovery would allow for collection of surface runoff (that may contain levels of pesticides that are above water quality thresholds) to be directed to a tailwater pond instead of a natural water body. This management practice also would greatly improve surface water quality over time. However, use of tailwater ponds could potentially impact groundwater quality over time due to increased infiltration. Sediment traps and buffer zones also would greatly improve surface water quality, as sediment can potentially carry hydrophobic contaminants to surface water bodies and excessive sediment can disrupt river ecosystems. Cover crops also improve both surface water quality and groundwater quality by preventing surface water runoff from entering surface water bodies and by reducing the amount of infiltration to groundwater.

Existing conditions, as outlined in the environmental setting above and in the ECR, cite that nine of the 30 watersheds in the program area have water quality impairments due to agricultural return flows that carry contaminants to surface water. Table 5.9-4 summarizes the number of known water quality impairments in each subwatershed.

Table 5.9-4. Known Surface Water Quality Impairments in Subwatersheds in the Program Area

Subwatershed	Pesticide applied to agricultural crops	Toxicity/unknown	Agriculture, grazing, or other sources	Physical constituents such as pH, DO or EC	Industrial point sources, agriculture, urban runoff, storm sewers, commercial	Legacy pesticide potentially mobilized by irrigated agricultural operations	Naturally occurring metal that is partly mobilized and concentrated by irrigated agriculture, causing toxic levels in receiving waters	Total number of known water quality impairments
Solano – Yolo	X	X	X					3
Colusa	X	X	X					13
Butte – Sutter	X	X	X					5
American River	X	X	X		X			4
Delta - Mendota Canal	X	X	X	X		X	X	25
San Joaquin Valley Floor	X	X	X	X		X	X	16
Delta Carbona	X	X	X	X	X	X	X	27
North Valley Floor	X	X	X	X		X	X	24
South Valley Floor	X	X	X	X		X	X	26
Sources: Central Valley Water Board 2007a, 2006 Section 303(d) List; Weston et al. in press; Kratzer et al. 2002; Kratzer et al. 2005; USGS 2005b, 2005c; Zamora et al. 2003; 2009 Staff Report on CWA Section 305(b) and 303(d).								

Tailwater recovery systems may reduce the amount of flow in some of the rivers, slightly altering hydrologic patterns, but the amount of alteration is not considered a significant hydrologic impact. Implementation of the management practices associated with Alternative 1 would not increase erosion or siltation. Use of coalitions to monitor surface water quality would not affect the course of a stream or river in the program area. In addition, implementation of management practices such as water management would affect only irrigated agriculture fields and would not alter any natural water body. Therefore, drainage patterns would not be affected from implementation of Alternative 1.

Overall, implementation of Alternative 1 would improve surface water quality over time in the subwatersheds with water quality impairments due to irrigated agriculture. Some of the management practices would slightly alter drainage patterns and runoff infiltration, but the amount of alteration is not considered a significant hydrologic impact compared to existing conditions. Some of the management practices could impact groundwater quality through infiltration during settling of particles. Because addressing groundwater quality is not part of Alternative 1, groundwater quality would continue to be impaired from agriculture practices. Implementation of **Mitigation Measure HYD-MM-1** would reduce this impact to a less-than-significant level.

Alternative 2 – Third-Party Lead Entity

Impact HYD-1. Change in Quality of State Waters from Agricultural Discharge or Alteration of Hydrologic Patterns of Runoff or Infiltration

Under Alternative 2, third-party groups would act as lead entities to monitor water quality, develop water quality management plans, organize growers, and report on program progress. In comparison with the current program (baseline), this alternative would allow for a reduction in surface water monitoring under lower threat circumstances and when management plans have been developed. This alternative also would require development of GQMPs to minimize discharge of wastes to groundwater.

Under Alternative 2, existing water quality impairments are expected to improve over time as third parties develop and implement surface water and groundwater quality management plans. Under these plans, growers would implement management practices to minimize the amount of wastes discharged to surface water and groundwater.

It is expected that this program alternative would improve existing surface water quality over time and decrease the amount of known water quality impairments, resulting in a net benefit to water quality in the program area.

Under Alternative 2, drainage patterns in the Central Valley would not be substantially affected by the management practices. Tailwater recovery systems may reduce the amount of flow in some of the rivers, slightly altering hydrologic patterns, but the amount of alteration is not considered a significant hydrologic impact. Implementation of the management practices associated with this alternative would not increase erosion or siltation. Use of third parties to monitor surface water quality would not affect the course of a stream or river in the program area. In addition, implementation of management practices such as water management would affect only irrigated agriculture fields and would not alter any natural water body. Therefore, drainage patterns would not be affected from implementation of Alternative 2.

The lack of groundwater monitoring would result in a reduced ability to determine the beneficial water quality impacts from implementation of GQMPs. Nevertheless, groundwater quality is expected to improve under Alternative 2 from implementation of the practices included in GQMPs. Implementation of Alternative 2 is considered beneficial to surface water and groundwater quality. Measuring the performance of implementation of GQMPs would not occur at the local level, but at the regional level through existing groundwater monitoring activities. No mitigation is required.

Alternative 3 – Individual Farm Water Quality Management Plans

Impact HYD-1. Change in Quality of State Waters from Agricultural Discharge or Alteration of Hydrologic Patterns of Runoff or Infiltration

Potential impacts to water quality and hydrology under Alternative 3 would be similar to those described for Alternative 2 because the types of management practices most likely to be implemented under Alternatives 2 and 3 are not expected to differ greatly. However, Alternatives 3, 4, and 5 involve a more geographically widespread range of implementation of practices.

Under Alternative 3, individual growers would work with the Central Valley Water Board or a designated implementing agency to develop an individual FWQMP that would be submitted to the Central Valley Water Board for approval. The Central Valley Water Board would be the lead entity under this alternative.

Implementation of Alternative 3 could result in greater benefits to water quality because of the Central Valley Water Board's involvement in approval of FWQMPs for unique situations that require unique management. The individual FWQMP would require:

- Growers to evaluate the effectiveness of management practices and report to the Central Valley Water Board on an annual basis,
- Growers to implement management practices to protect surface and groundwater, and
- The Central Valley Water Board or the MOU entity to conduct annual site inspections on a selected number of operations and review available water quality monitoring data to determine the effectiveness of the FWQMPs.

FWQMPs would include such practices as monitoring installed tailwater return systems, reviewing erosion prevention practices, conducting visual monitoring, and reviewing nutrient applications.

Under Alternative 3, existing surface water quality and groundwater quality impairments are expected to improve over time as the FWQMPs are developed and implemented. However, unless specifically required due to surface water quality and groundwater quality problems, Alternative 3 would not mandate surface water and groundwater quality monitoring. Implementation of FWQMPs would require a small amount of physical monitoring, including:

- Visual monitoring of tailwater systems to ensure no off-site discharge,
- Review of erosion prevention practices after storm events,
- Visual monitoring of turbidity in discharges, and
- Review of nutrient applications and estimated crop uptake.

As with Alternatives 1 and 2, implementation of management practices under Alternative 3 is not expected to significantly alter drainage patterns in adjacent streams or rivers.

If regional monitoring efforts determine that water quality is being impacted by irrigated agriculture, additional management practices would be required in the FWQMPs, along with surface water and groundwater quality monitoring. As a result, implementation of Alternative 3 is expected to improve both surface water quality and groundwater quality over time. No mitigation is required.

Alternative 4 – Direct Oversight with Regional Monitoring

Impact HYD-1. Change in Quality of State Waters from Agricultural Discharge or Alteration of Hydrologic Patterns of Runoff or Infiltration

Potential impacts to water quality and hydrology under Alternative 4 would be similar to those described for Alternative 2. However, since Alternatives 3, 4 and 5 involve a more geographically widespread range of management practices, program area impacts might be greater.

Under Alternative 4, individual growers or legal entities assuming responsibility for waste discharge would work directly with the Central Valley Water Board. This alternative provides the option for group monitoring and reporting conducted by a third-party. Under Alternative 4, regulatory requirements would be scaled using tiered, threat-based criteria. Higher threat operations would be required to implement additional management practices and more extensive monitoring than lower threat operations. All growers would be required to develop an individual FWQMP. The Central Valley Water Board or legal entities would be the lead.

Implementation of Alternative 4 would be similar to implementation of Alternative 3, except for legal entities being the lead for conducting monitoring. Under Alternative 4, existing surface water quality impairments are expected to improve over time as the FWQMPs are developed and implemented. Because this alternative requires FWQMPs to specify groundwater management practices, groundwater quality also is expected to improve over time. As with the other alternatives, implementation of management practices is not expected to significantly alter drainage patterns in adjacent streams or rivers. No mitigation is required.

Alternative 5 – Direct Oversight with Farm Monitoring

Impact HYD-1. Change in Quality of State Waters from Agricultural Discharge or Alteration of Hydrologic Patterns of Runoff or Infiltration

Potential impacts to water quality and hydrology under Alternative 5 would be similar to those described for Alternative 2.

Under Alternative 5, individual growers would work directly with the Central Valley Water Board. Growers would be required to develop and implement an FWQMP and a nutrient management plan. The Central Valley Water Board would be the lead entity.

Implementation of Alternative 5 would be similar to implementation of Alternative 3 where growers would take the lead for conducting monitoring and developing FWQMPs. Development of a nutrient management plan would increase protection for surface water and groundwater quality. The requirement of a GQMP under Alternative 5 also is expected to benefit groundwater quality.

Monitoring wells would be installed in certain areas to collect groundwater quality data. The contractor would adhere to all state and local permits required for well construction, and water supply would not be affected from these wells since they would be purged only for water quality samples. Both surface water quality and groundwater quality are expected to improve over time with implementation of this alternative. As with the other alternatives, implementation of management practices under Alternative 5 is not expected to significantly alter drainage patterns in adjacent streams or rivers. No mitigation is required.

5.9.5 Mitigation and Improvement Measures

Mitigation Measure HYD-MM-1: Develop and Implement a Groundwater Quality Management Plan

Growers will design GQMPs to minimize waste discharge to groundwater from irrigated agricultural lands. Development of GQMPs involves collection and evaluation of available groundwater data, identification of GMAs of concern, identification of constituents of concern within the GMAs, prioritization of the GMAs and constituents of concern, identification of agricultural practices that may be causing or contributing to the problem, and identification of agricultural management practices that should be implemented by local growers to address the constituents of concern. The GQMPs will be reviewed by Central Valley Water Board staff, and approved only after staff judge that the implementation measures are adequate to meet the groundwater quality objectives of the Basin Plan and the State Antidegradation Policy.

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ICF INTERNATIONAL

Figure 5.9-1
Program Boundaries and Subdivisions

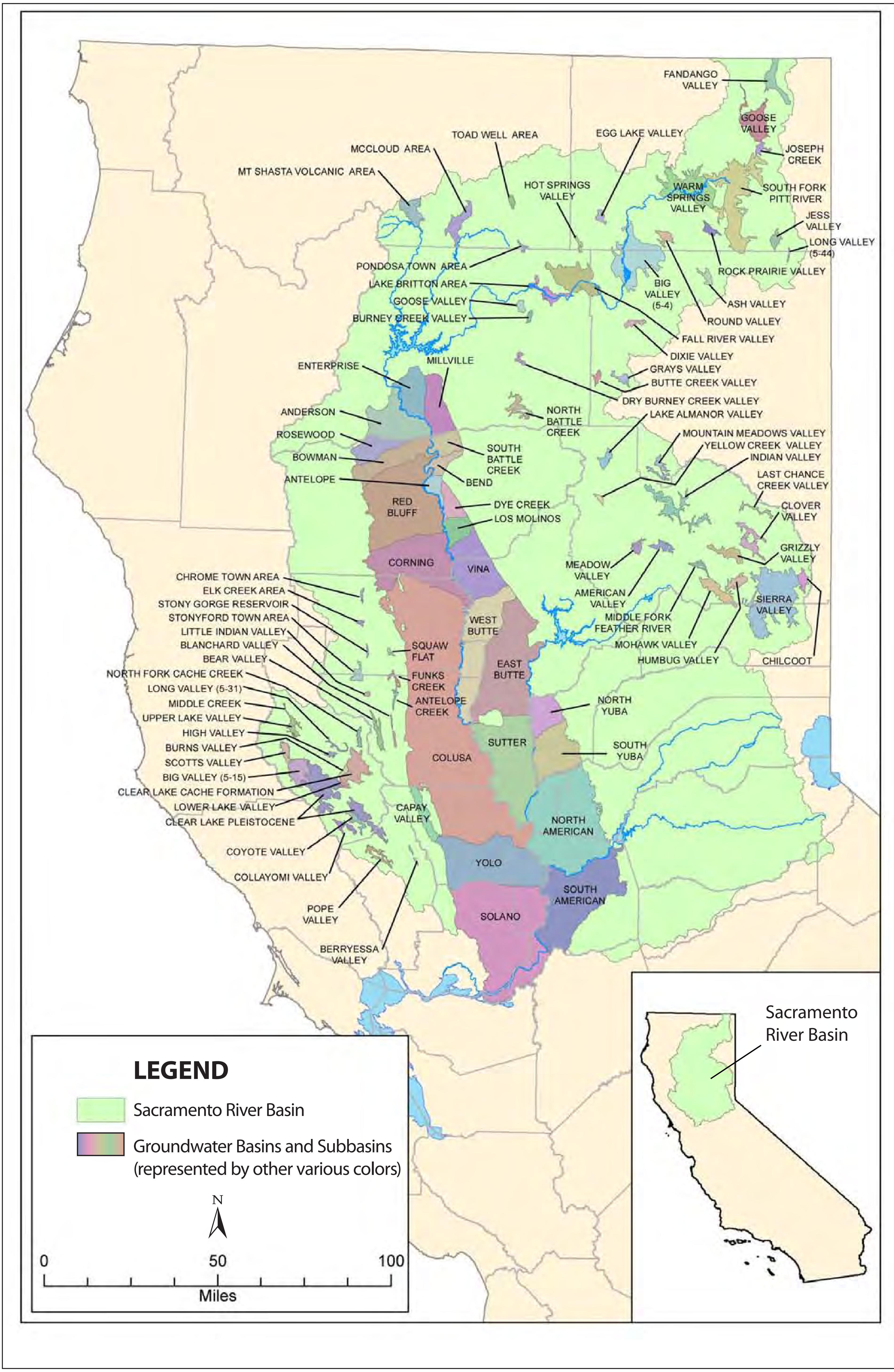

Figure 5.9-2
Sacramento River Basin Groundwater Basins and Subbasins

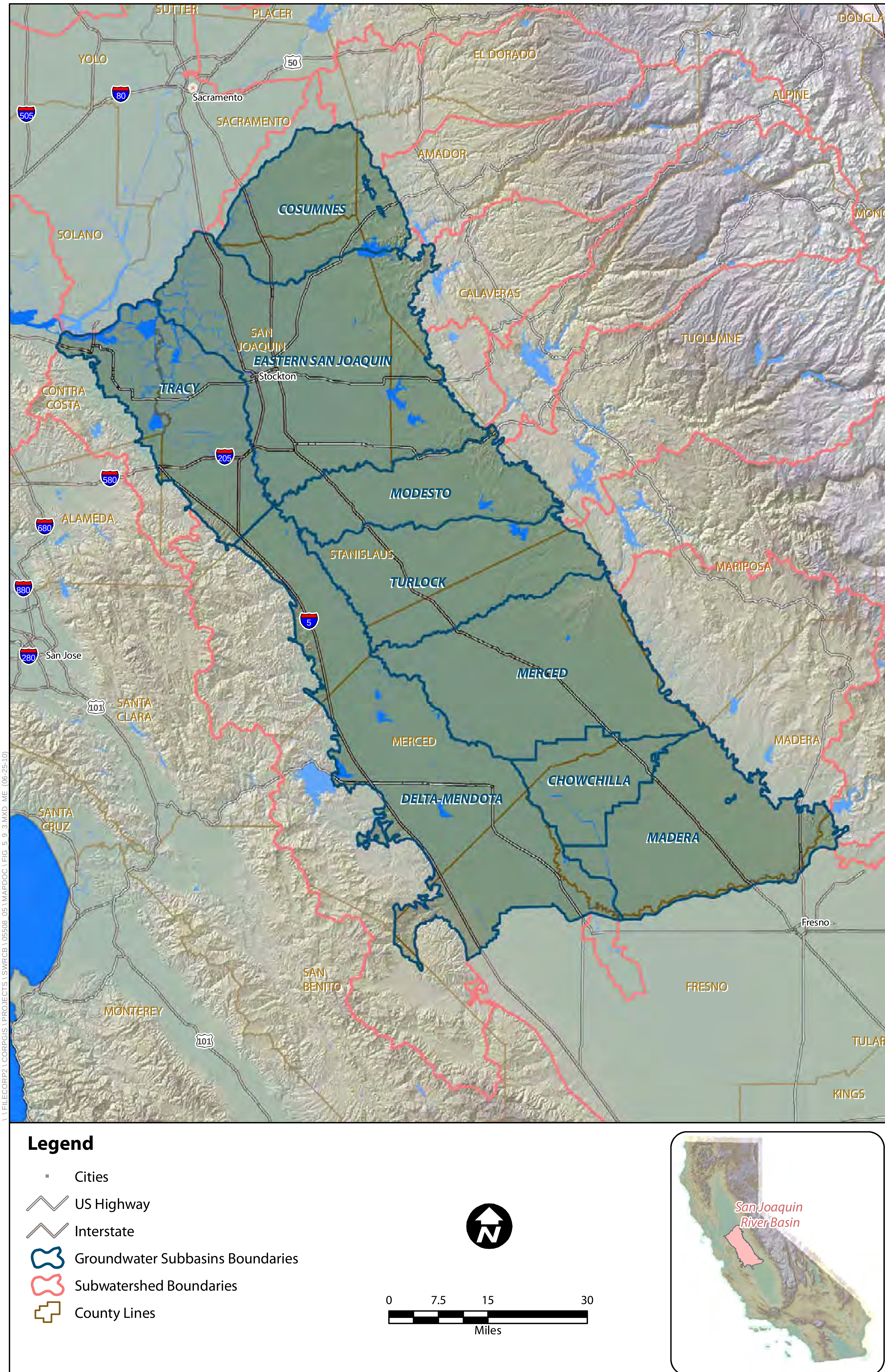

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Figure 5.9-3
San Joaquin River Basin Groundwater Subbasins

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Figure 5.9-4
Tulare Lake Basin Groundwater Basins and Subbasins

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Figure 5.9-5
Sacramento River Basin Subwatersheds

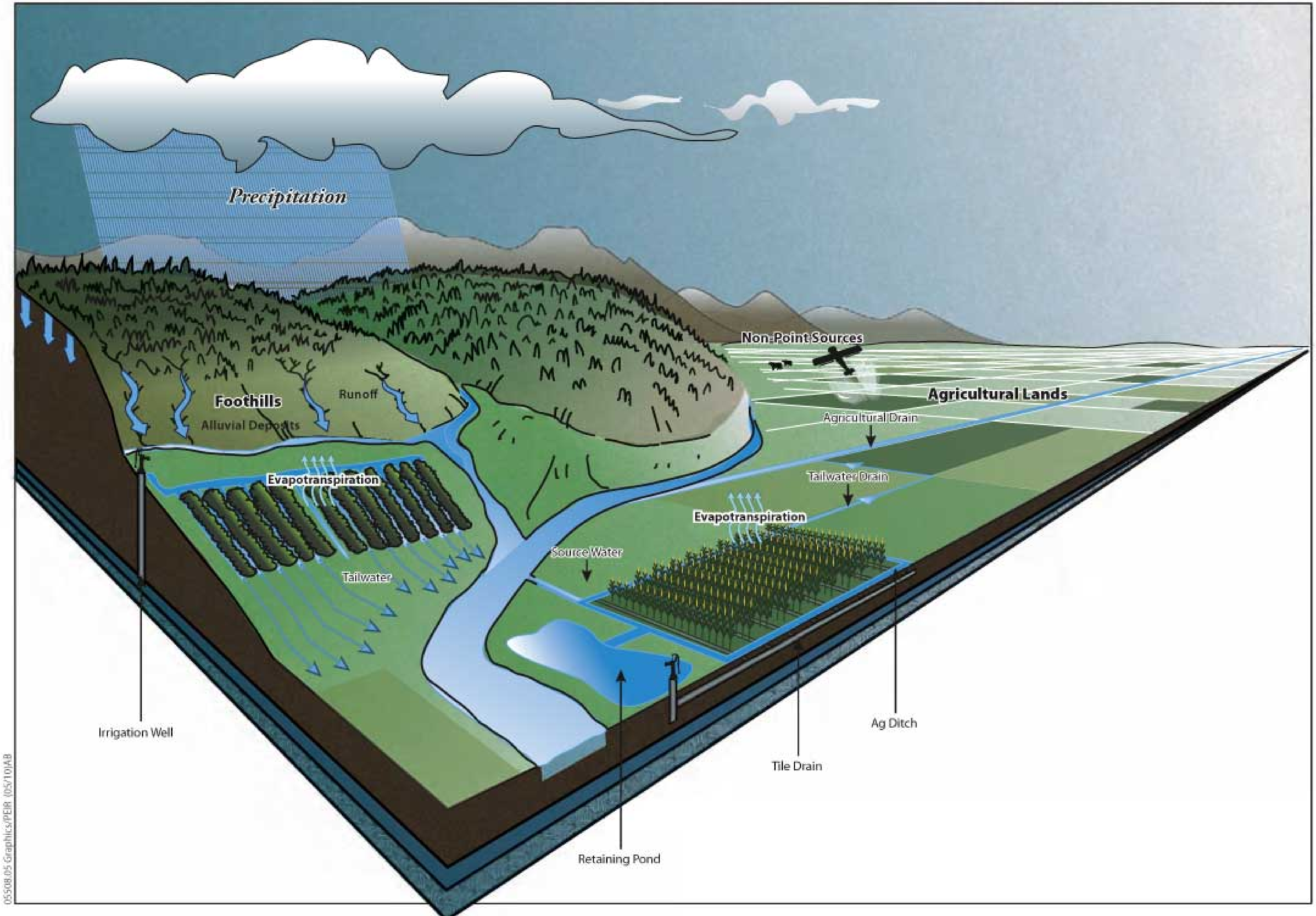

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Figure 5.9-6
Conceptual Surface Water Model

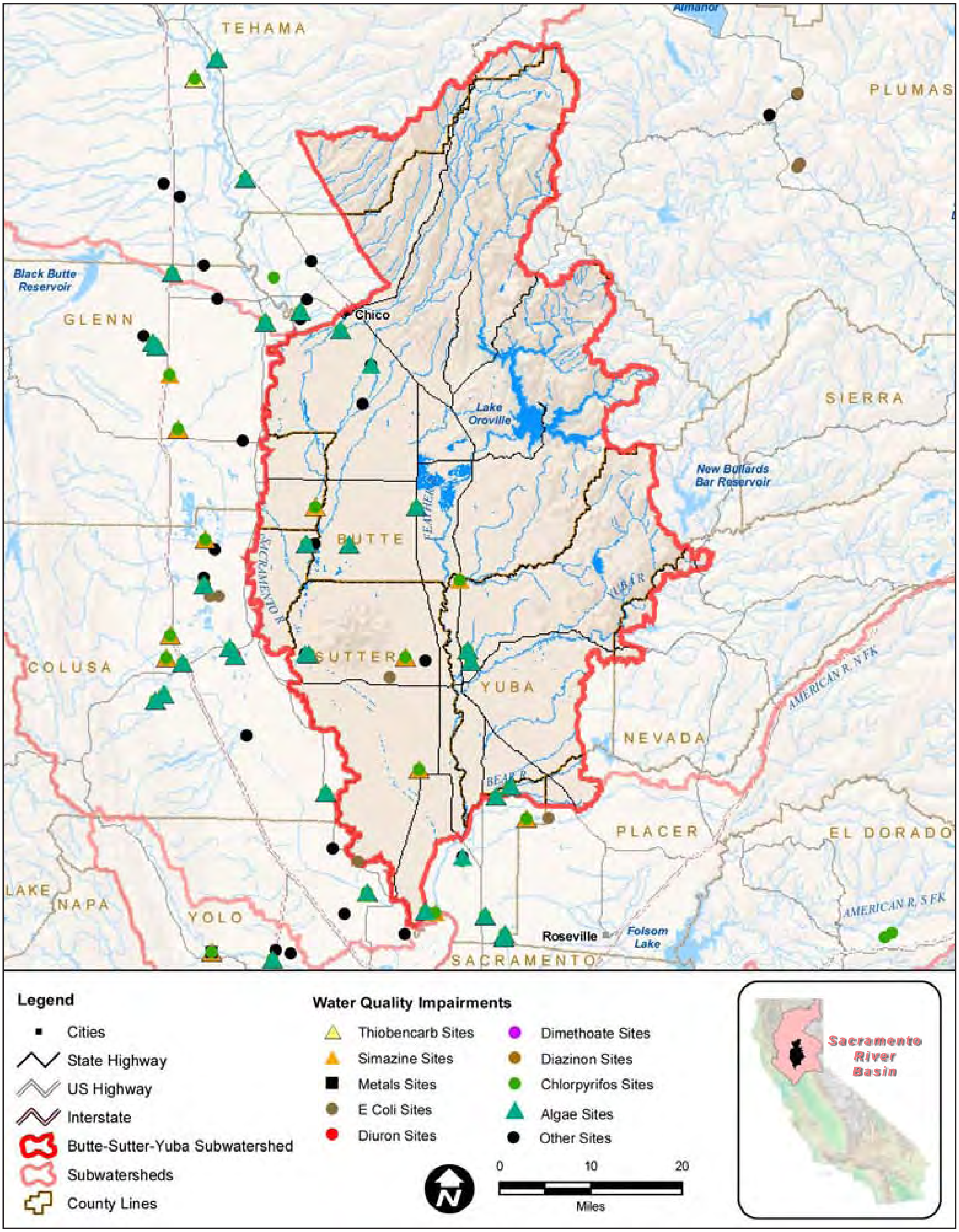

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Figure 5.9-7
Butte-Sutter-Yuba Subwatershed

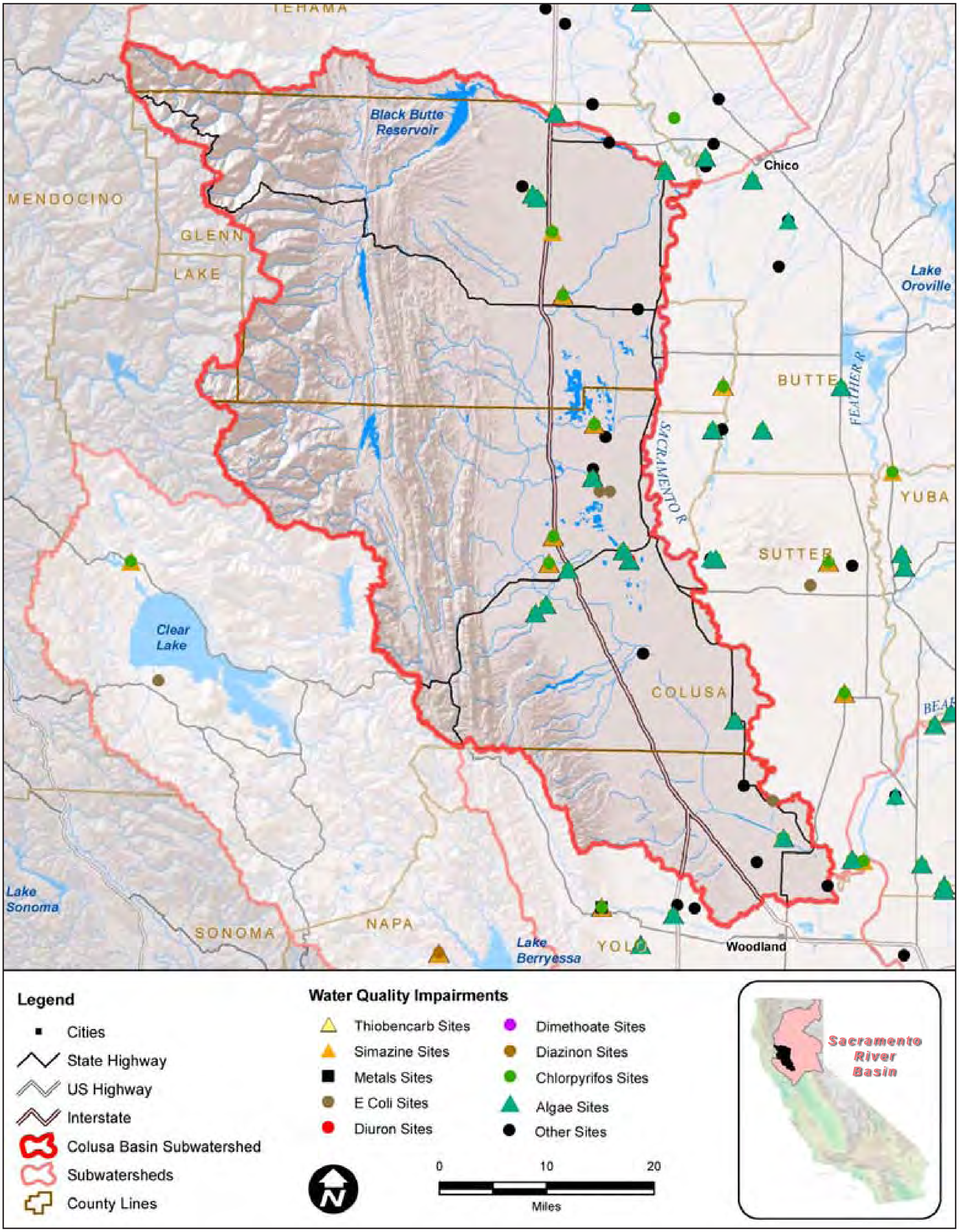

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Figure 5.9-8
Colusa Basin Subwatershed

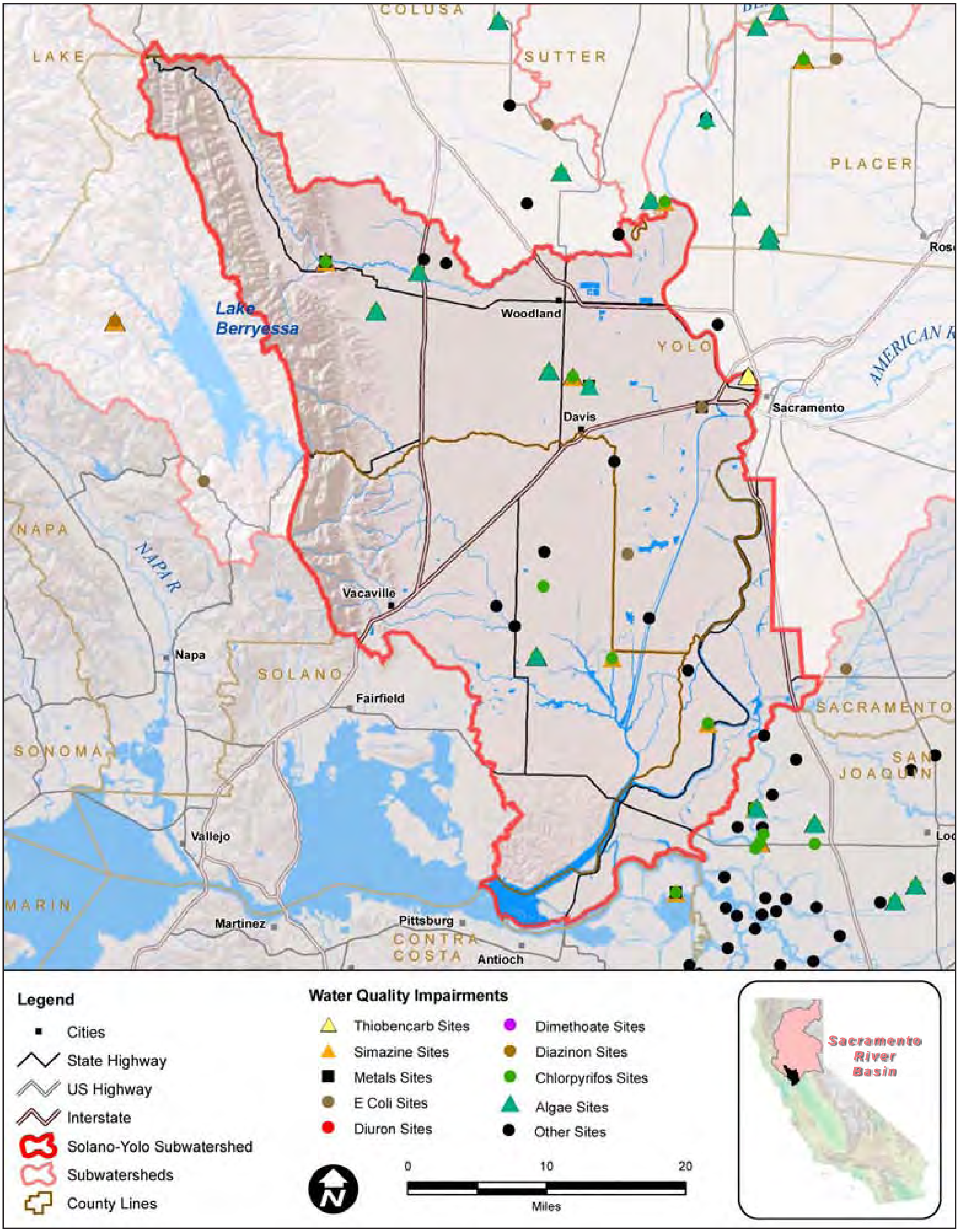

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Figure 5.9-9
Solano-Yolo Subwatershed

Graphics ... 05508.05 PEIR (06/10) JD

Figure 5.9-10
San Joaquin River Basin Subwatersheds

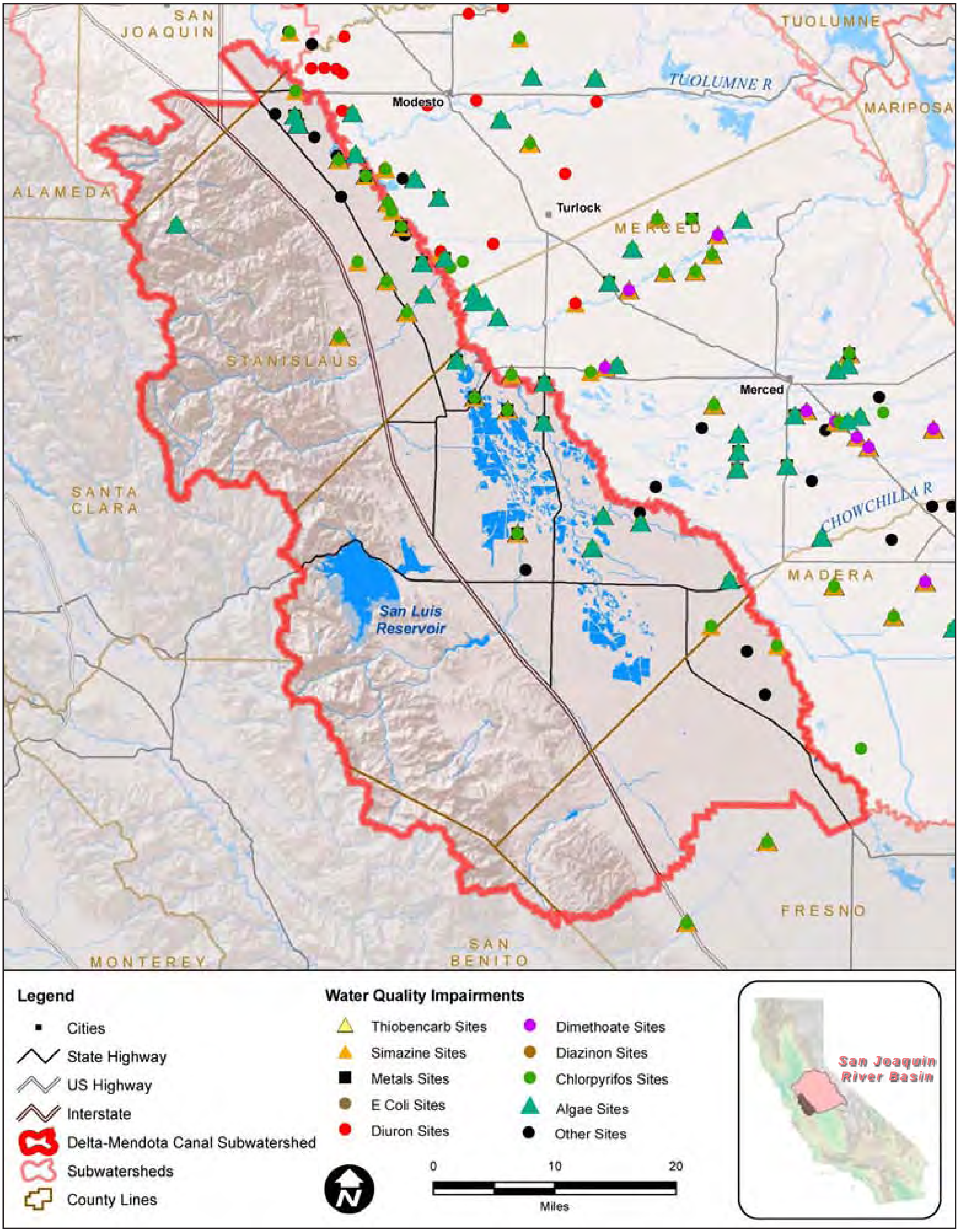

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Figure 5.9-11
Delta-Mendota Canal Subwatershed

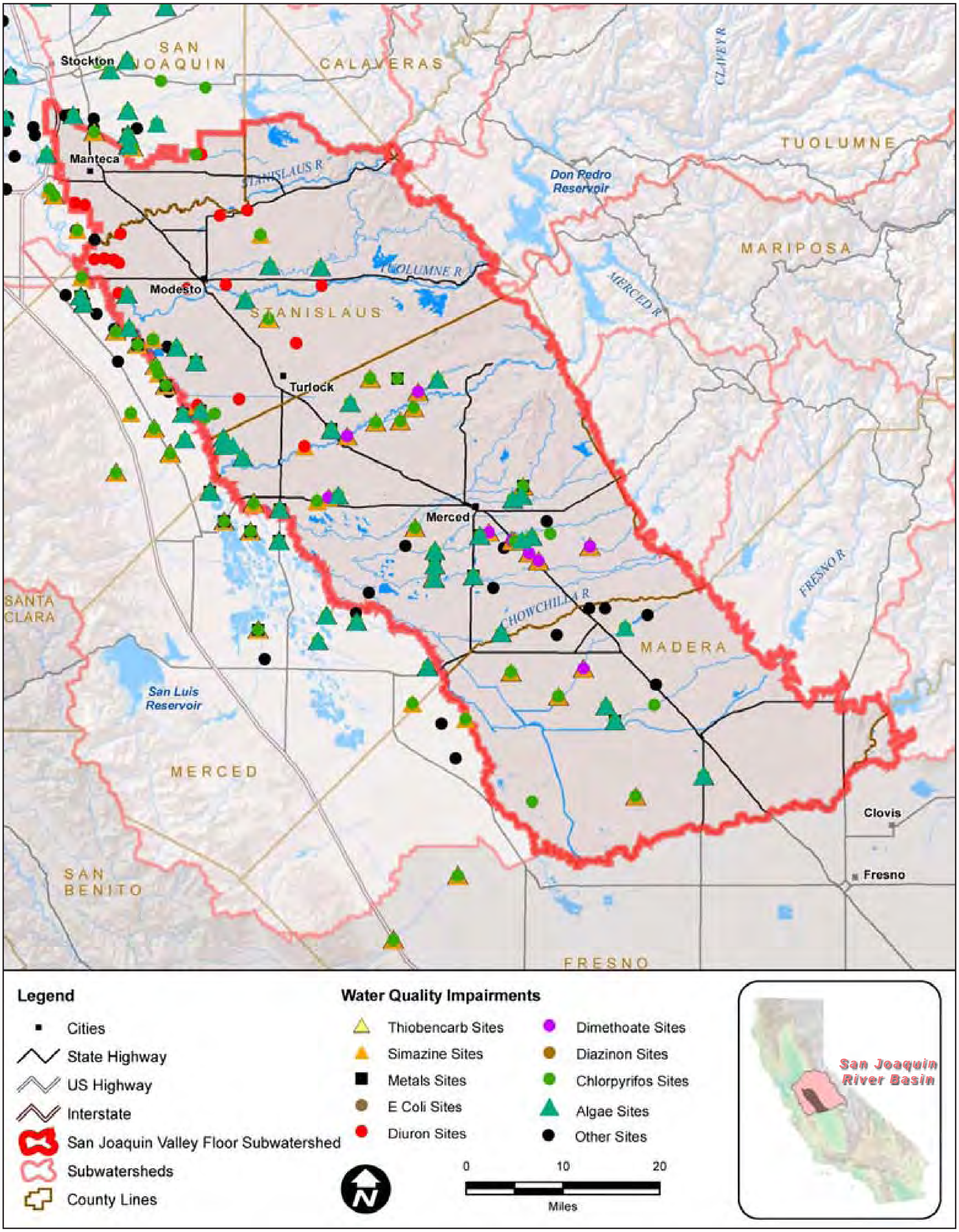

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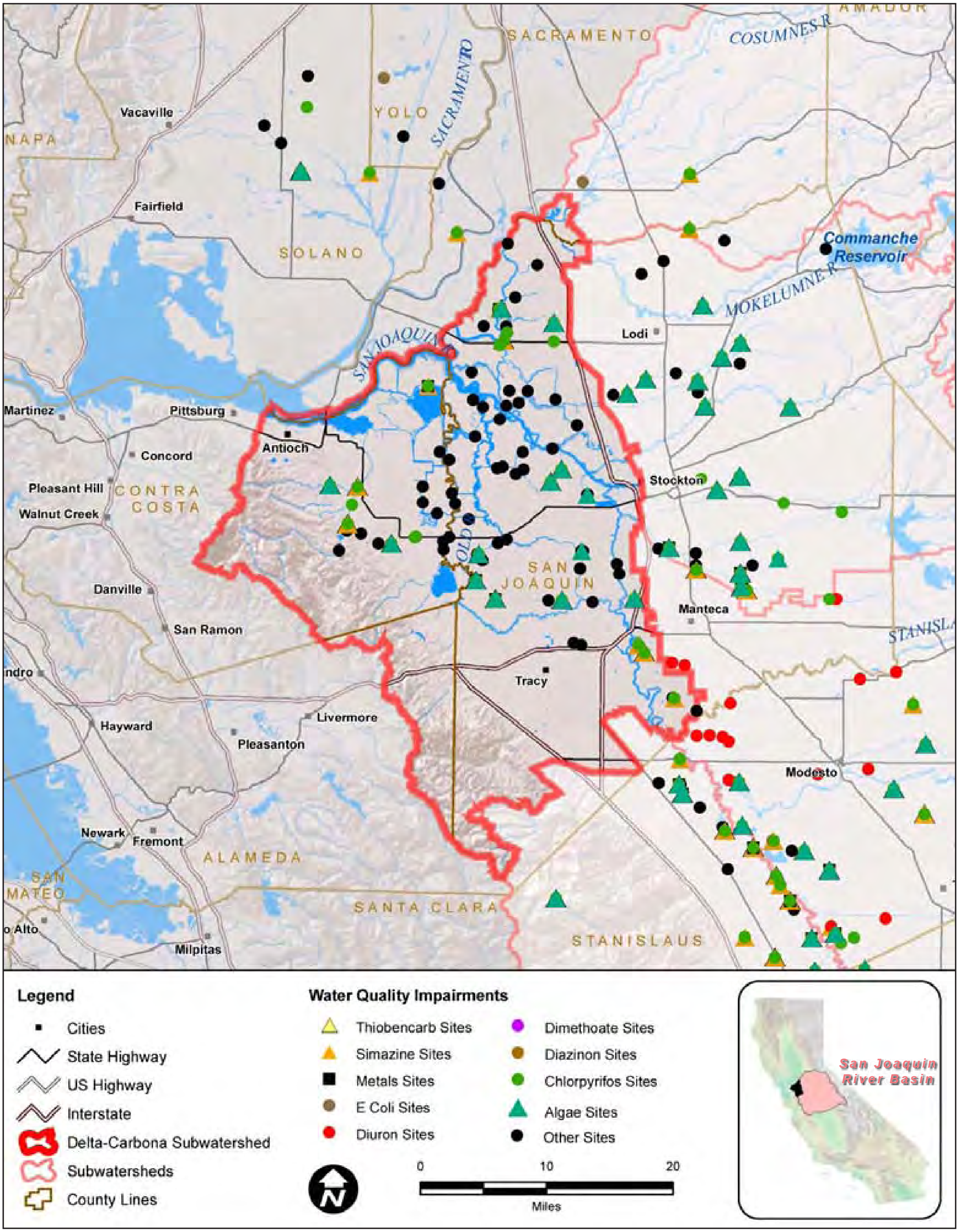
Figure 5.9-12
San Joaquin Valley Floor Subwatershed



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ICF INTERNATIONAL

Figure 5.9-13
Delta-Carbona Subwatershed

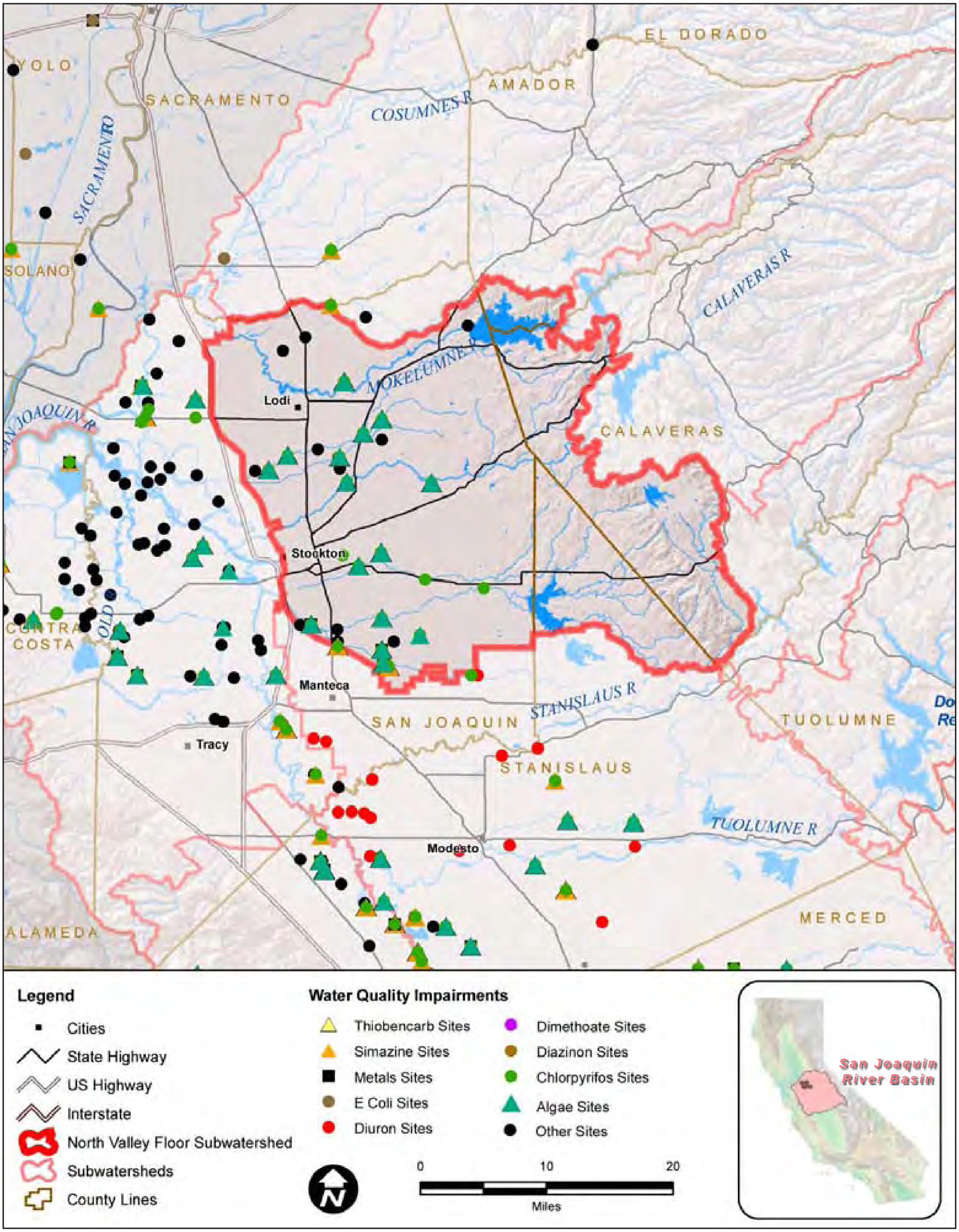

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Figure 5.9-14
North Valley Floor Subwatershed

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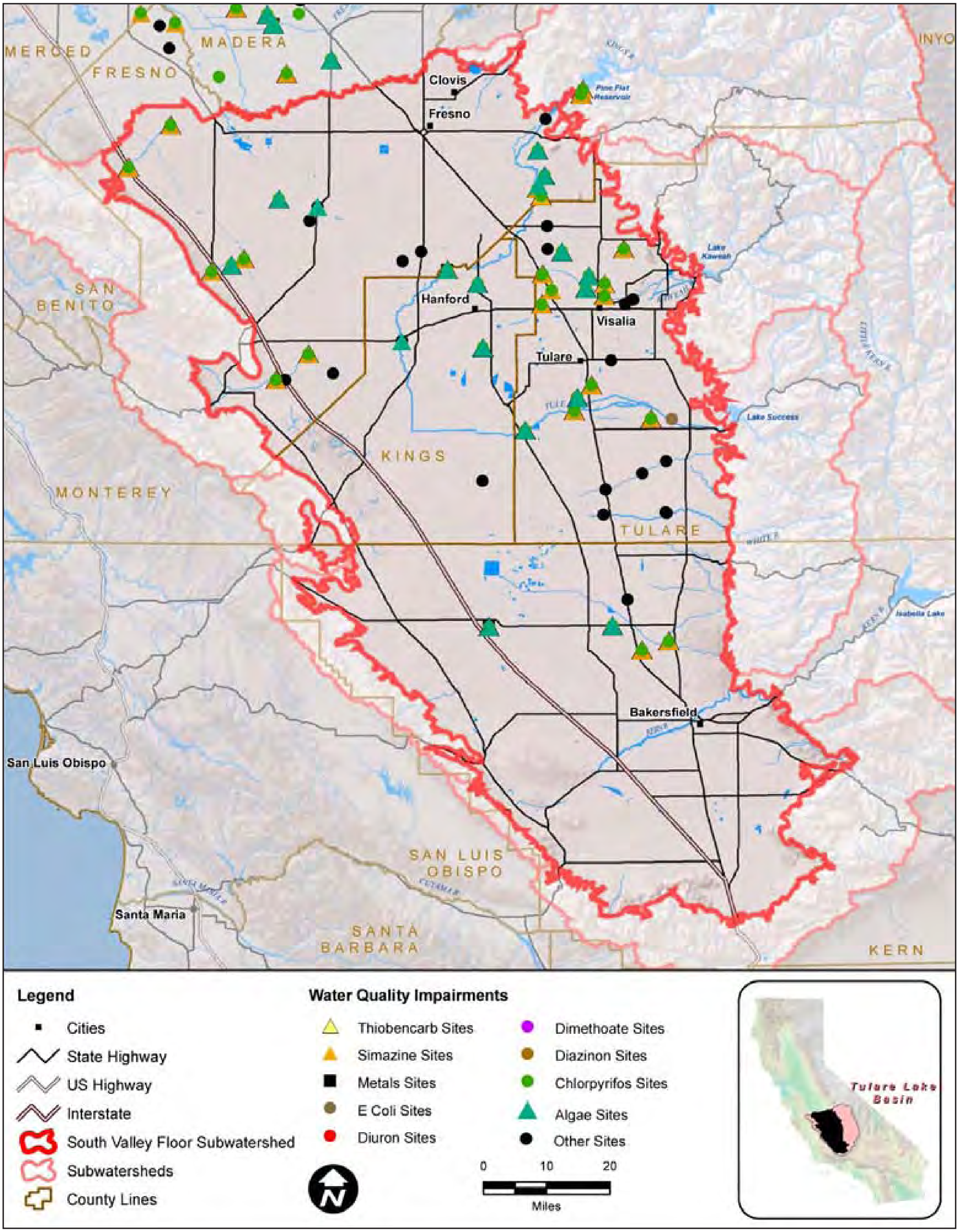
Figure 5.9-15
Tulare Lake Basin Subwatersheds



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ICF INTERNATIONAL

Figure 5.9-16
South Valley Floor Subwatershed

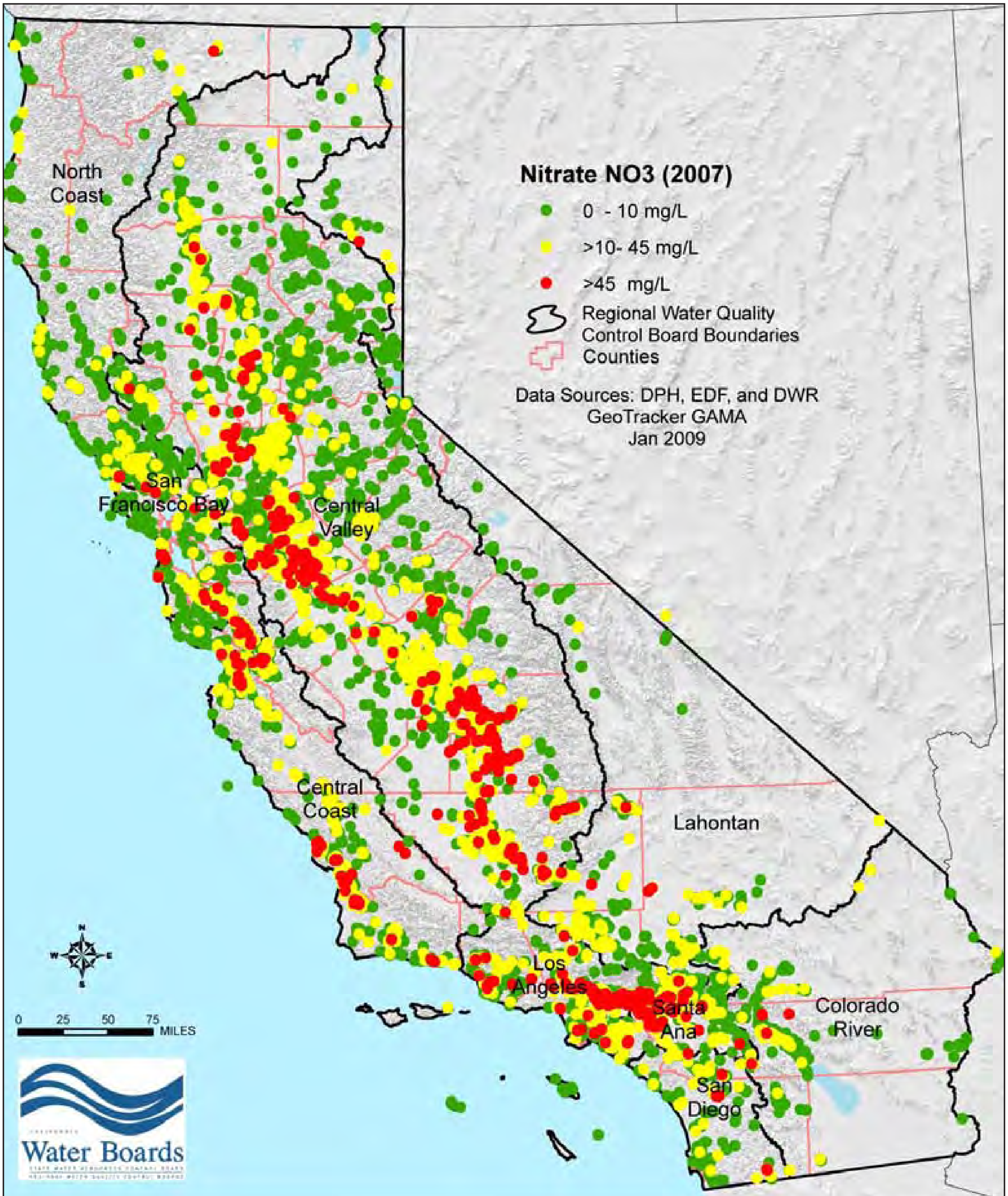

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Figure 5.9-17
Nitrate in California's Groundwater

Section 5.10
Agriculture Resources

5.10.1 Introduction

This section describes agricultural land uses in the program area and identifies the potential for impacts on agriculture resources that could be caused by implementation of the various ILRP alternatives. This programmatic evaluation focuses on the potential for the conversion of agricultural lands to nonagricultural uses as a result of increased costs associated with compliance with the ILRP alternatives. The catalyst for these impacts is the cost of achieving and maintaining compliance with the alternatives as discussed in *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program* (ICF International 2010) (Draft ILRP Economics Report), incorporated herein by reference.

Of approximately 100 million acres of land in California, approximately 43 million acres are used for agricultural purposes (Thompson 2009). The program area covers approximately 39 million acres, of which approximately 7.8 million acres are irrigated for the purpose of growing crops (ICF International 2010). California is a major global supplier of food, producing more than 400 different agricultural commodities, and is the nation's principal producer of many specialty crops such as almonds, figs, raisins, artichokes, and olives. Agricultural exports reached $10.9 billion in 2007, with total cash receipts for agricultural products (excluding livestock and poultry) of $25.8 billion (CDFA 2009). Of the top 10 most agriculturally productive counties in the nation, nine are located in California, with all or parts of eight of those counties located within the boundaries of the Central Valley Water Board (CDFA 2009).

Impacts on agriculture resources can be characterized generally as those that cause the conversion of agricultural lands to a nonagricultural use. In many instances, this occurs as conversion to urban or built-up land, particularly lands close to already urbanized areas (CDFA 2009). Examples of this conversion can be seen near relatively large metropolitan areas that are surrounded by agricultural lands, such as Sacramento, Stockton, and Fresno. As the cities grow, nearby agricultural lands are converted to make room for new housing developments, shopping malls, and other uses associated with urban environments. Besides urbanization, other factors that can affect agricultural land conversions are low-density development, water availability issues, intentional land idling, and economics.

As the name implies, the ILRP deals specifically with irrigated agricultural lands, which represent only a fraction of those lands classified as agricultural. In some cases, irrigated agricultural lands are converted, not to a nonagricultural use, but to a nonirrigated agricultural use such as dryland farming or grazing land. For purposes of the following analysis, such conversions would not constitute a significant impact. With respect to CEQA, significant impacts on agriculture resources typically are those that cause high-quality farmlands to be converted to nonagricultural uses. The specific thresholds that define such impacts are discussed further in Section 5.10.4.

5.10.2 Regulatory Framework

This section discusses federal, state, and local regulations related to agriculture that may apply to the program alternatives.

Federal

There are no federal regulations related to agriculture that would apply to the program alternatives.

State

Farmland Mapping and Monitoring Program

The California Department of Conservation, Division of Land Resource Protection, administers the Farmland Mapping and Monitoring Program (FMMP), which maps important farmland throughout California. Information regarding locations of farmland by category is readily available, and the potential conversion of FMMP lands is addressed in this document. The farmland categories listed under the FMMP are the basis of the State CEQA Guidelines significance thresholds, as discussed in "Significance Thresholds," below. The categories are defined pursuant to USDA land inventory and monitoring criteria, as modified for California.

- *Prime Farmland* is land with the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed in accordance with accepted farming methods. In addition, the land must have been used for irrigated agricultural production in the last 4 years to qualify as Prime Farmland.
- *Farmland of Statewide Importance* is land other than Prime Farmland that has a good combination of physical and chemical characteristics for the production of crops.
- *Unique Farmland* is land that does not meet the criteria for Prime Farmland or Farmland of Statewide Importance, and that has been used for the production of specific high–economic-value crops at some time during the two update cycles prior to the mapping date. This land is usually irrigated but may include nonirrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the 4 years prior to the mapping date.
- *Farmland of Local Importance* is currently producing crops, has the capability of production, or is used for production of confined livestock.
- *Grazing Land* is land on which the existing vegetation, whether grown naturally or through management, is suitable for grazing or browsing of livestock.
- *Urban and Built-Up Land* is used for residential, industrial, commercial, construction, institutional, and public administrative purposes; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water control structures; and other developed purposes.
- *Other Land* is land that is not included in any other mapping categories.

- *Land Committed to Nonagricultural Use* is land that is permanently committed by local elected officials to nonagricultural development by virtue of decisions that cannot be reversed by a majority vote of a city council or county board of supervisors.

Williamson Act and Farmland Security Zone Contracts

The California Land Conservation Act (Government Code Section 51200 et seq.) of 1965, commonly known as the Williamson Act, provides a tax incentive for the voluntary enrollment of agricultural and open space lands in contracts between local government and landowners. The contract enforceably restricts the land to agricultural and open space uses and compatible uses defined in state law and local ordinances. An agricultural preserve, which is established by local government, defines the boundary of an area within which a city or county will enter into contracts with landowners. The State of California has the following policies regarding public acquisition of and locating public improvements on lands in agricultural preserves and on lands under Williamson Act contracts (Government Code Sections 51290–51295).

(a) It is the policy of the state to avoid, whenever practicable, the location of any federal, state, or local public improvements and any improvements of public utilities, and the acquisition of land therefor, in agricultural preserves.

(b) It is further the policy of the state that whenever it is necessary to locate such an improvement within an agricultural preserve, the improvement shall, whenever practicable, be located upon land other than land under a contract pursuant to this chapter.

(c) It is further the policy of the state that any agency or entity proposing to locate such an improvement shall, in considering the relative costs of parcels of land and the development of improvements, give consideration to the value to the public, as indicated in Article 2 (commencing with Section 51220), of land, and particularly prime agricultural land, within an agricultural preserve.

Since 1998, another option in the Williamson Act Program has been established with the creation of Farmland Security Zone contracts. A *Farmland Security Zone* is an area created within an agricultural preserve by a board of supervisors upon the request of a landowner or group of landowners. Farmland Security Zone contracts offer landowners greater property tax reduction and have a minimum initial term of 20 years. Like Williamson Act contracts, Farmland Security Zone contracts renew annually unless a notice of nonrenewal is filed.

California Conservation Easements

Conservation easements are voluntarily established restrictions that are permanently attached to property deeds, with the general purpose of retaining land in its natural, open space, agricultural, or other condition while preventing uses that are deemed inconsistent with the specific conservation purposes expressed in the easements. Agricultural conservation easements define conservation purposes that are tied to keeping land available for continued use as farmland. Such farmlands remain in private ownership, and the landowner retains all farmland use authority, but the farmland is restricted in its ability to be subdivided or used for nonagricultural purposes, such as urban uses.

The California Farmland Conservancy Program (PRC Section10200 et seq.) supports the voluntary granting of agricultural conservation easements from landowners to qualified nonprofit organizations, such as land trusts, as well as local governments. Potential impacts on conservation easements would be addressed in subsequent project-level documents.

Local

County Land Use Regulations and Ordinances

Most local jurisdictions (cities and counties) have policies and regulations that protect agriculture resources or regulate land use and farmland. These may include establishment of agricultural preserves or agricultural districts, policies protecting identified farmland, and agricultural zoning. The land use and agriculture regulations in county ordinances vary widely. Specific local policies are not addressed in this program-level analysis.

5.10.3 Environmental Setting

The area to be covered under the ILRP includes all or part of 38 of the state's 58 counties. Three major watersheds have been delineated within this region, namely the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin (Figure 2-1). The three basins cover approximately 40 percent of the total area of the state and approximately 75 percent of the irrigated acreage (Central Valley Water Board 2002a).

Sacramento River Basin

The Sacramento River Basin contains the entire drainage area of the Sacramento River and its tributaries (approximately 27,210 square miles) from the northeast corner of California to Sacramento County (Figure 2-2). The basin drains approximately one-third of total runoff in the state into the middle and lower reaches of the Sacramento River.

Land uses in the Sacramento River Basin are principally forest and range lands in the upper reaches, with urban development focused around the city of Sacramento. Agriculture is the dominant land use on the valley floor, followed by urban development.

The Sacramento River Basin encompasses approximately 12.2 million acres. Of this amount, 2.4 million acres are classified as agricultural lands. The majority of these irrigated acres occur on the valley floor. Rice is the primary crop in the Sacramento River Basin, particularly in the Colusa and Butte-Sutter-Yuba Subwatersheds, where poorly drained soils provide ideal conditions. Other principal crop types are field crops, orchards, pasture, and grains.

Agricultural land uses account for less than 10 percent of total acreage in the Pit River, Shasta-Tehama, Upper Feather River–Upper Yuba River, American River, and Lake Napa Subwatersheds.

San Joaquin River Basin

The San Joaquin River Basin drains a region of approximately 15,880 square miles that extends across the Central Valley to the Coast Ranges, between the Cosumnes River to the north and the San Joaquin River to the south (Figure 2-3). The San Joaquin River Basin encompasses approximately 9.8 million acres. In general, the basin is dominated by native vegetation. The primary tributaries in the basin are the Stanislaus River, Tuolumne River, and Merced River, which meet with the San Joaquin River in the valley floor. The basin is dominated by agriculture at the confluence of the San Joaquin and these various rivers. The San Joaquin River Basin includes most of the Delta as well as the Delta-Mendota Canal, a highly manipulated component of the CVP. Multiple canals in the Delta-

Mendota Canal Subwatershed deliver water to agricultural operations and then back to the natural drainages. Many tributaries in the watershed that otherwise would be dry during the summer irrigation season flow year-round because of agricultural return flows.

Approximately 2 million acres in the basin are classified as agricultural. Agricultural land uses in the basin are concentrated in the valley floor—specifically in the Delta-Mendota Canal, San Joaquin Valley Floor, Delta-Carbona, and North Valley Floor Subwatersheds. There is very little agriculture in the remaining subwatersheds, less than 1 percent in most cases. The primary crops that are produced in the San Joaquin River Basin are field crops, pasture, deciduous fruits and nut orchards, vineyards, and grain and hay.

Tulare Lake Basin

The Tulare Lake Basin encompasses an approximately 17,650–square mile drainage area from Fresno to the southern end of the Central Valley near the Grapevine (Figure 2-4).

Much of the topography in the Tulare Lake Basin is dominated by steep river canyons and large mountains, typical of the Sierra Nevada and Coast Ranges. The basin encompasses approximately 10.7 million acres. Of this amount, 3.6 million acres are classified as agricultural. The vast majority of this agricultural land is located in the South Valley Floor Subwatershed (3.5 million acres), largely because of topography. In comparison with other subwatersheds in the Tulare Lake Basin, the South Valley Floor Subwatershed is relatively flat. Consequently, the bulk of water quality concerns related to the Tulare Lake Basin involve agricultural operations and agricultural return flows in the South Valley Floor Subwatershed.

Because of the amount of land in the Tulare Lake Basin that is in the Sierra Nevada and the Coast Ranges, most of the basin is dominated by native vegetation and includes little urban development. In the upper watershed areas, irrigated agriculture accounts for less than 2 percent of land uses in the Kings River, Kaweah River, Kern River, Grapevine, Coast Range, Sunflower Valley, and Southern Sierra Subwatersheds—with just slightly more in the Temblor Subwatershed (3.3 percent). There is no agriculture in the Fellows Subwatershed. The primary crop types in the Tulare Lake Basin as a whole are grain and hay crops, pasture, and deciduous fruits and nuts. The primary crop types in the South Valley Floor Subwatershed are field crops, followed by deciduous fruits and nuts, vineyards, pasture, and grain and hay.

5.10.4 Impacts

Impacts on agriculture resources from the program alternatives would result from the costs to growers of program implementation. This section describes the potential impacts related to agriculture resources resulting from the five program alternatives. For the purposes of this analysis, the baseline conditions were assumed to be the current regulatory program as instituted at the time of the writing of the ECR (refer to Chapter 3).

The assessment of impacts on agriculture resources was accomplished using information gathered from various state and federal agencies. Technical documents related to the economics of agriculture in California also were referenced. The following key references were used to compile this section:

- U.S. Department of Agriculture. 2009. *2007 Census of Agriculture*. United States Summary and State Data. Volume 1.
- ICF International. 2010. *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program*.
- California Department of Conservation. 2004. *California Farmland Conversion Report 2000–2002*.
- California Department of Conservation. 2006. *California Farmland Conversion Report 2002–2004*.
- California Department of Conservation. 2008. *California Farmland Conversion Report 2004–2006*.
- Central Valley Production Model.
- DWR land use data.

These references were consulted and considered in light of the results of the Draft ILRP Economics Report in determining the significance of an impact to agriculture resources in the program area.

Significance Determinations

Thresholds of Significance

In accordance with the State CEQA Guidelines, the Central Valley Water Board found that implementation of an ILRP alternative would result in a significant impact on agriculture resources if it would:

- Convert prime farmland, unique farmland, or farmland of statewide importance to nonagricultural use; or
- Involve other changes in the existing environment that, because of their location or nature, could result in the conversion of farmland to nonagricultural use.

Assessment Methods

The Central Valley Production Model (CVPM) is a regional model of irrigated agricultural production and economics that simulates the decisions of agricultural producers (farmers) in the Central Valley of California. The model assumes that farmers maximize profit subject to resource, technical, and market constraints. CVPM has been used to assess the impacts on irrigated agriculture of implementing a number of water-related policy changes. The model can be linked to hydrologic impact analysis in order to show how water supply changes affect agricultural production. It also can be used to assess how crop production, irrigated acreage, and revenue are affected by changes in production costs.

As detailed in the Draft ILRP Economics Report, outputs of the CVPM indicate that varying amounts of farmland dedicated to the production of particular crop types may be removed from production under each ILRP alternative. The predicted lost production acreage would result from net increased operational costs to growers as a result of implementing the alternatives. As the Draft ILRP Economics Report discusses, narrower profit margins would make specific low-margin crop types most vulnerable to lost production. It is important to note that that the terminology "lost from production" or "removed from production," as used in this draft PEIR and the Draft ILRP Economics Report, does not necessarily mean that the land no longer would be used to produce crops, only that it would not be used to produce the particular crop type in question. It is reasonable and logical to assume that, while some portion of the affected farmland would be converted to nonagricultural use, a majority of the lost acreage would not be converted to a nonagricultural use but instead would be used to produce a crop that would require lower compliance costs and generate sufficient revenue to stay in agricultural production.

The size of the region and the programmatic nature of the analysis prevent drawing conclusions concerning which specific parcels of land would be most vulnerable. Thus, the possible impacts on protected agriculture resources were quantified by overlaying the CVMP vulnerability results with the FMMP farmland types to determine what ratio of vulnerable crop types are contained within FMMP-identified lands of significance, making those lands at risk for conversion or removal from production.

To conduct the analysis, the quantity of prime farmland, unique farmland, or farmland of statewide or local importance that could be converted was estimated. The locations of crop types shown to be vulnerable in the Draft ILRP Economics Report were determined using DWR land use data. Table 5.10-1 shows the aggregated crop types used for the analyses. The crop type data were overlaid onto FMMP farmland data to calculate what percentage of vulnerable crop types are located within prime farmland, unique farmland, or farmland of statewide importance. These ratios of crop type to farmland classification were applied to the outputs of the CVPM economic assessment to determine maximum acreages of lost protected farmland by crop type. The resulting calculations quantify the approximate loss of production, in acres, by farmland classification.

For example; in the Sacramento River Basin, there are approximately 435,000 acres of ORVIN, defined as orchard or vineyard. Of those acres, approximately 315,000 (72 percent) acres occur on prime farmland. The CVPM output indicates that Alternative 1 would result in removal from production of 1,600 acres of ORVIN in the Sacramento River Basin. Under the assumption that farmland loss for a particular crop type would occur proportionally across the various farmland classifications, the analysis indicates that approximately 72 percent of the 1,600 acres lost would be from prime farmland, resulting in a loss of 1,150 acres of ORVIN on prime farmland. These calculations were carried out for all three crop type groupings across all three watersheds, resulting in an approximation of total acreage removed from production per farmland classification.

Table 5.10-1. Crop Category Definition

Abbreviated Crop Category	Aggregated Crop Category	Existing Conditions Crop Category*
FFGO	Field, Forage, Grain, Other	Field Crops, Grain and Hay, Irrigated Pasture, Rice
ORVIN	Orchard, Vineyard	Citrus and Subtropical, Deciduous Orchard, Vineyard
VEGT	Vegetable, Truck	Vegetable and Truck

* Idle (IDLE) and semi-agricultural and incidental (SEMI) were not included in the aggregated crop categories.

A table is provided for each alternative in the impact analysis that shows the total acreages, grouped by important farmland classification that potentially would be converted to another crop type or land use[1].

[1] For purposes of the impact analysis, *important farmland* is defined as farmland identified as prime, unique, or of statewide importance by the FMMP.

This analysis assumes that all types of irrigated lands would be removed from production proportionally to their prevalence within a vulnerable crop category. Losses of important farmland shown for Alternatives 2 through 5 are incremental, representing losses in addition to those of Alternative 1(the existing program).

The economic analysis revealed that, under all alternatives, the greatest loss of productive land would result when growers of low-value crops select relatively costly management practices. Therefore, this analysis adopts that finding and determines the impacts to agriculture resources of those increased costs and resulting loss of production. It is highly likely that growers would avoid these impacts where possible by identifying and enacting practices that would minimize their compliance costs. However, due to the probability that use of costly management practices will be unavoidable in some circumstances, it is concluded that conversion of prime farmland, unique farmland, or farmland of statewide importance to nonagricultural use will result from implementation of all ILRP alternatives.

Alternative 1 – Full Implementation of Current Program (No Project Alternative)

Impact AG-1. Conversion of Prime Farmland, Unique Farmland, and Farmland of Statewide Importance to Nonagricultural Use

Alternative 1 involves full implementation of the existing regulatory program. Coalition groups would function as the lead entities, and growers would implement management practices when surface water monitoring data show two or more exceedances of water quality objectives. Table 5.10-2 shows that, under Alternative 1, a total of 328,653 acres of important farmland potentially would be removed from production because of the increased costs associated with complying with the ILRP. As previously stated, it is unlikely that all of this acreage would be converted to a nonagricultural use, but it is reasonable to assume that some unknown quantity would be. This analysis indicates that, of the five alternatives, Alternative 1 likely would result in the smallest impact with regard to the total amount of important farmland removed from production.

Because implementation of Alternative 1 potentially would result in conversion of prime farmland, unique farmland, and farmland of statewide importance to nonagricultural use, this impact is considered significant. Implementation of **Mitigation Measure AG-MM-1** would reduce the magnitude of the impact, but not to a less-than-significant level.

Table 5.10-2 Acres of Important Farmland Potentially Removed from Production under Alternative 1

Watershed/ Crop Type	Farmland Classification: Prime	Unique	Statewide Importance	Total Acreage
Sacramento River				
VEGT	2,944	156	153	3,254
ORVIN	1,098	187	219	1,504
FFGO	102,218	26,565	25,795	154,578
Total	106,260	26,909	26,167	159,335
San Joaquin River				
VEGT	1,880	146	491	2,517
ORVIN	973	477	393	1,843
FFGO	76,768	24,994	35,868	137,630
Total	79,621	25,617	36,753	141,990
Tulare Lake				
VEGT	269	13	106	388
ORVIN	254	28	110	391
FFGO	11,495	1,735	13,318	26,548
Total	12,018	1,776	13,534	27,327
Grand Total	197,898	54,301	76,454	328,653

VEGT = vegetable, truck; ORVIN =orchard, vineyard; FFGO = field, forage, grain, other.

Note: Totals may not exactly match those found in *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program* (ICF International 2010) as a result of rounding.

Alternative 2 – Third-Party Lead Entity

Potential impacts on agriculture resources resulting from Alternative 2 would be in addition to those described for Alternative 1; **Impact AG-1** would apply.

Impact AG-1. Conversion of Prime Farmland, Unique Farmland, and Farmland of Statewide Importance to Nonagricultural Use

Under Alternative 2, third-party groups (e.g., water quality coalitions) would function as lead entities representing growers. Regulation of discharges to surface water under Alternative 2 would be similar to Alternative 1 (the current ILRP). Table 5.10-3 shows that, under Alternative 2, 9,596 additional acres of important farmland potentially would be removed from production because of the increased costs associated with complying with the ILRP. It is unlikely that all of this acreage would be converted to a nonagricultural use, but it is reasonable to assume that some unknown quantity would be.

Because implementation of Alternative 2 potentially would result in conversion of prime farmland, unique farmland, and farmland of statewide importance to nonagricultural use, this impact is considered significant. Implementation of **Mitigation Measure AG-MM-1** would reduce the magnitude of the impact, but not to a less-than-significant level.

Table 5.10-3. Additional Acres of Important Farmland Potentially Removed from Production under Alternative 2

Watershed/ Crop Type	Farmland Classification: Prime	Unique	Statewide Importance	Total Acreage
Sacramento River				
VEGT	17	1	1	19
ORVIN	14	2	3	19
FFGO	1,009	262	255	1,526
Total	1,040	265	258	1,564
San Joaquin River				
VEGT	72	6	19	97
ORVIN	307	151	124	582
FFGO	3,879	1,263	1,812	6,954
Total	4,258	1,419	1,955	7,632
Tulare Lake				
VEGT	7	0	3	10
ORVIN	19	2	8	29
FFGO	156	24	181	361
Total	182	26	192	400
Grand Total	5,480	1,710	2,406	9,596

VEGT = vegetable, truck; ORVIN =orchard, vineyard; FFGO = field, forage, grain, other.

Note: Totals may not exactly match those found in *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program* (ICF International 2010) as a result of rounding.

Alternative 3 – Individual Farm Water Quality Management Plans

Potential impacts on agriculture resources resulting from Alternative 3 would be in addition to those described for Alternative 1; **Impact AG-1** would apply.

Impact AG-1. Conversion of Prime Farmland, Unique Farmland, and Farmland of Statewide Importance to Nonagricultural Use

Under Alternative 3, growers would have the option to work directly with the Central Valley Water Board or another implementing entity (e.g., CACs) in development of an FWQMP. Growers individually would apply for a conditional waiver or WDRs that would require obtaining Central Valley Water Board approval of their FWQMP. Table 5.10-4 shows that, under Alternative 3, 43,680 additional acres of important farmland potentially would be removed from production because of the increased costs associated with complying with the ILRP. It is unlikely that all of this acreage would be converted to a nonagricultural use, but it is reasonable to assume that some unknown quantity would be.

Because implementation of Alternative 3 potentially would result in conversion of prime farmland, unique farmland, and farmland of statewide importance to nonagricultural use, this impact is considered significant. Implementation of **Mitigation Measure AG-MM-1** would reduce the magnitude of the impact, but not to a less-than-significant level.

Table 5.10-4. Additional Acres of Important Farmland Potentially Removed from Production under Alternative 3

	Farmland Classification			
Watershed/ Crop Type	**Prime**	**Unique**	**Statewide Importance**	**Total Acreage**
Sacramento River				
VEGT	260	14	14	287
ORVIN	206	35	41	282
FFGO	12,319	3,202	3,109	18,630
Total	12,785	3,251	3,163	19,199
San Joaquin River				
VEGT	217	17	57	290
ORVIN	410	201	166	776
FFGO	11,541	3,758	5,392	20,691
Total	12,168	3,975	5,615	21,758
Tulare Lake				
VEGT	67	3	27	97
ORVIN	63	7	27	98
FFGO	1,095	165	1,268	2,528
Total	1,225	176	1,322	2,723
Grand Total	26,178	7,401	10,100	43,680

VEGT = vegetable, truck; ORVIN =orchard, vineyard; FFGO = field, forage, grain, other.
Note: Totals may not exactly match those found in *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program* (ICF International 2010) as a result of rounding.

Alternative 4 – Direct Oversight with Regional Monitoring

Potential impacts on agriculture resources resulting from Alternative 4 would be in addition to those described for Alternative 1; **Impact AG-1** would apply.

Impact AG-1. Conversion of Prime Farmland, Unique Farmland, and Farmland of Statewide Importance to Nonagricultural Use

Under Alternative 4, the Central Valley Water Board would develop WDRs and/or a conditional waiver of WDRs for waste discharge from irrigated agricultural lands to groundwater and surface water. Growers, or legal entities responsible for a group of growers' waste discharges, would apply directly with the Central Valley Water Board to obtain coverage ("direct oversight"). Table 5.10-5 shows that, under Alternative 4, 11,799 additional acres of important farmland potentially would be removed from production because of the increased costs associated with complying with the ILRP. It is unlikely that all of this acreage would be converted to a nonagricultural use, but it is reasonable to assume that some unknown quantity would be.

Because implementation of Alternative 4 potentially would result in conversion of prime farmland, unique farmland, and farmland of statewide importance to nonagricultural use, this impact is considered significant. Implementation of **Mitigation Measure AG-MM-1** would reduce the magnitude of the impact, but not to a less-than-significant level.

Table 5.10-5. Additional Acres of Important Farmland Potentially Removed from Production under Alternative 4

	Farmland Classification			
Watershed/ Crop Type	**Prime**	**Unique**	**Statewide Importance**	**Total Acreage**
Sacramento River				
VEGT	87	5	5	96
ORVIN	69	12	14	94
FFGO	53	14	13	80
Total	208	30	32	270
San Joaquin River				
VEGT	72	6	19	97
ORVIN	358	176	145	679
FFGO	5,440	1,771	2,542	9,752
Total	41,319	13,432	19,074	73,825
Tulare Lake				
VEGT	0	0	0	0
ORVIN	63	7	27	98
FFGO	391	59	453	903
Total	454	66	480	1001
Grand Total	6,553	2,048	3,217	11,799

VEGT = vegetable, truck; ORVIN =orchard, vineyard; FFGO = field, forage, grain, other.

Note: Totals may not exactly match those found in *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program* (ICF International 2010) as a result of rounding.

Alternative 5 – Direct Oversight with Farm Monitoring

Potential impacts on agriculture resources resulting from Alternative 5 would be in addition to those described for Alternative 1; **Impact AG-1**would apply.

Impact AG-1. Conversion of Prime Farmland, Unique Farmland, and Farmland of Statewide Importance to Nonagricultural Use

Alternative 5 would consist of general WDRs designed to protect surface water and groundwater from discharges associated with irrigated agriculture. All growers would be required to apply for and obtain coverage under the general WDRs. Table 5.10-6 shows that, under Alternative 5, 249,490 additional acres of important farmland potentially would be removed from production because of the increased costs associated with complying with the ILRP. This analysis indicates that, of the five alternatives, Alternative 5 likely would have the greatest impact with regard to the total amount of important farmland removed from production. It is unlikely that all of this acreage would be converted to a nonagricultural use, but it is reasonable to assume that some unknown quantity would be.

Because implementation of Alternative 5 potentially would result in the conversion of prime farmland, unique farmland, and farmland of statewide importance to nonagricultural use, this impact is considered significant. Implementation of **Mitigation Measure AG-MM-1** would reduce the magnitude of the impact, but not to a less-than-significant level.

Table 5.10-6. Additional Acres of Important Farmland Potentially Removed from Production under Alternative 5

	Farmland Classification			
Watershed/ Crop Type	**Prime**	**Unique**	**Statewide Importance**	**Total Acreage**
Sacramento River				
VEGT	1,905	101	99	2,105
ORVIN	1,646	281	329	2,256
FFGO	72,269	18,782	18,237	109,288
Total	75,821	19,164	18,665	113,650
San Joaquin River				
VEGT	1,301	101	340	1,742
ORVIN	1,741	853	704	3,298
FFGO	57,044	18,572	26,653	102,269
Total	60,086	19,527	27,697	107,309
Tulare Lake				
VEGT	806	40	318	1,164
ORVIN	2,346	259	1,014	3,619
FFGO	10,283	1,552	11,914	23,749
Total	13,436	1,850	13,246	28,532
Grand Total	149,342	40,541	59,608	249,490

VEGT = vegetable, truck; ORVIN =orchard, vineyard; FFGO = field, forage, grain, other.

Note: Totals may not exactly match those found in *Technical Memorandum Concerning the Economic Analysis of the Irrigated Lands Regulatory Program* (ICF International 2010) as a result of rounding.

5.10.5 Mitigation and Improvement Measures

Mitigation Measure AG-MM-1: Assist the Agricultural Community in Identifying Sources of Financial Assistance That Would Allow Growers to Keep Important Farmland in Production

The Central Valley Water Board will assist the agricultural community in identifying sources of financial assistance from existing federal, state, or local programs that promote water conservation and water quality through increased management practices. Funding received from grants, cost-sharing, or low-interest loans would offset some of the local growers' expenditures for compliance and implementation of FWQMPs, and likely would reduce the estimated losses in irrigated acreage. Potential funding sources for this mitigation measure are discussed below. The programs described below are illustrative and are not intended to constitute a comprehensive list of funding sources.

Federal Farm Bill

Title II of the 2008 Farm Bill (the Food, Conservation, and Energy Act of 2008, in effect through 2012) authorizes funding for conservation programs such as the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program. Both of these programs provide financial and technical assistance for activities that improve water quality on agricultural lands.

State Water Resources Control Board

The Division of Financial Assistance administers water quality improvement programs for the State Water Board. The programs provide grant and loan funding to reduce non-point-source pollution discharge to surface waters.

The Division of Financial Assistance currently administers two programs that improve water quality—the Agricultural Drainage Management Loan Program and the Agricultural Drainage Loan Program. Both of these programs were implemented to address the management of agricultural drainage into surface water. The Agricultural Water Quality Grant Program provides funding to reduce or eliminate the discharge of non-point-source pollution from agricultural lands into surface water and groundwater. It currently is funded through bonds authorized by Proposition 84.

The State Water Board's Clean Water State Revolving Fund also has funding authorized through Proposition 84. It provides loan funds to a wide variety of point-source and non-point-source water quality control activities.

Potential Funding Provided by the Safe, Clean, and Reliable Drinking Water Supply Act of 2010

This act was passed by the Legislature as SBX 7-2 and, if approved by voters in November 2010, would provide grant and loan funding for a wide range of water-related activities, including agricultural water quality improvement, watershed protection, and groundwater quality protection. The actual amount and timing of funding availability will depend on its passage, on the issuance of bonds and the release of funds, and on the kinds of programs and projects proposed and approved for funding.

Other Funding Programs

Other state and federal funding programs have been available in recent years to address agricultural water quality improvements. Integrated Regional Water Management grants were authorized and funded by Proposition 50 and now by Proposition 84. These are administered jointly by the State Water Board and DWR. Proposals can include agricultural water quality improvement projects. Reclamation also can provide assistance and cost-sharing for water conservation projects that help reduce discharges.

Section 5.11
Minimally Impacted Resources

5.11.1 Introduction

Pursuant to CEQA Guideline Section 15126.2, an EIR shall identify and focus on the significant environmental effects of the proposed program. Due to the programmatic nature of the analysis, the Lead Agency has determined that no significant direct or indirect environmental impacts would affect the resources listed below.

5.11.2 Discussion of Minimally Impacted Resources

Aesthetics

While the program alternatives foresee possible construction activity in relation to management practice enactment, any such activity is reasonably expected to occur within presently active agricultural acreage and thus is unlikely to interfere with, degrade, or damage scenic resources.

Geology and Soils

The program alternatives would result in a beneficial effect, if any, on geology and soils; management practices enacted to minimize sediment discharges would slow or prevent soil erosion or the loss of topsoil. The program alternatives would result in no foreseeable seismic impacts, nor otherwise undermine soil stability.

Hazards and Hazardous Materials

The program alternatives would result in a slight beneficial effect, if any, relating to hazardous materials by decreasing nutrient and pesticide usage and thereby lessening the incidence of transportation, and accidental or intentional discharge of such materials. The program alternatives would result in no foreseeable significant impacts that would create or result in other hazardous conditions.

Land Use and Planning

While the program alternatives foresee possible conversion of agricultural lands as a result of increased management practice-related costs, no specific use for converted land can be identified, due to the unknown location of such lands. Determining whether such unknown converted uses would conflict with any applicable land use plan, policy or regulation is unreasonably speculative. Thus, the program alternatives would result in no foreseeable land use and planning-related significant impacts.

Mineral Resources and Energy

The program alternatives would not result in the foreseeable loss of any known mineral resource.

Population and Housing

While the program alternatives foresee possible conversion of agricultural lands as a result of increased management practice-related costs, no specific use for converted land can be identified, due to the unknown location of such lands. It is too speculative to determine whether such unknown converted uses would induce substantial population growth. Refer to see Section 6.3, Growth-Inducing Impacts, for a discussion of the extent of foreseeable impacts of land conversion.

The program alternatives would not result in foreseeable displacement of housing or populations.

Public Services

The program alternatives would not result in foreseeable significant impacts to public service, or lead to the necessity for additional public service facilities. Refer to see Section 6.3, Growth-Inducing Impacts, for a discussion of the extent of foreseeable impacts of land conversion.

Recreation

It is not anticipated that the program alternatives would substantially increase or decrease the use of recreational facilities, create the need for such facilities, or result in any other foreseeable significant impact on recreational opportunities in the program area.

Transportation and Circulation

It is not anticipated that the program alternatives would substantially increase or decrease the existing traffic load in the program area. While additional onsite monitoring would be necessary under some alternatives, the alternatives also may decrease traffic flow through reduced needs for nutrients and pesticide deliveries. Regardless, any determination of increased or decreased traffic in relation to baseline conditions would be speculative at this programmatic level.

Utilities and Service Systems

The program alternatives would result in a beneficial effect, if any, related to utilities and service systems by improving water quality and thereby lessening the burden on existing water treatment facilities and reducing the need for new such facilities. The program alternatives would result in no foreseeable significant impacts that would cause a burden on existing utilities or service systems.