Chapter 1
Introduction

1. Introduction

The California Department of Boating and Waterways (DBW) operates the Water Hyacinth Control Program (WHCP). A key goal of the WHCP is to keep waterways safe and navigable by controlling the growth and spread of water hyacinth in the Sacramento-San Joaquin Delta (Delta), and its surrounding tributaries. The WHCP is California's oldest, and largest, aquatic weed control program.

The WHCP was established over twenty-six years ago by the California Legislature in 1982 with the passage of Senate Bill 1344. The law has been amended since that time (with minor wording changes and with the *Egeria densa* Control Program added to the code in 1997) . Section 64 of the Harbors and Navigation Code currently reads as follows:

"(a) The Legislature hereby finds and declares that the growth of water hyacinth and *Egeria densa* in the Sacramento-San Joaquin Delta, its tributaries, and the Suisun Marsh has occurred at an unprecedented level and the resulting accumulations of water hyacinth and *Egeria densa* obstruct navigation, impair other recreational uses of waterways, have the potential for damaging manmade facilities, and may threaten the health and stability of fisheries and other ecosystems within the delta and marsh. Accordingly, it is necessary that the state, in cooperation with agencies of the United States, undertake an aggressive program for the effective control of water hyacinth and *Egeria densa* in the delta, its tributaries, and the marsh.

"(b) The department is designated as the lead agency of the state for the purpose of cooperating with agencies of the United States and other public agencies in controlling water hyacinth and *Egeria densa* in the delta, its tributaries, and the marsh."

Exhibit 1-1, on the next page, illustrates the location of the WHCP. The WHCP operates within the Delta, and three major tributaries: the San Joaquin, Merced, and Tuolumne Rivers. **Exhibit 1-2**, on page 1-3, provides an illustration of the legal boundaries of the Sacramento-San Joaquin Delta, as defined by Section 12220 of the California Water Code.[i]

This chapter of the Draft Program Environmental Impact Report (PEIR) describes the approach of this Draft PEIR document, describes the purpose of the Draft PEIR, provides historical background on the WHCP. This chapter is organized as follows:

A. Organization of the WHCP Draft PEIR
B. Purpose of the WHCP Draft PEIR
C. History of the WHCP.

Exhibit 1-1
The Delta and its Tributaries

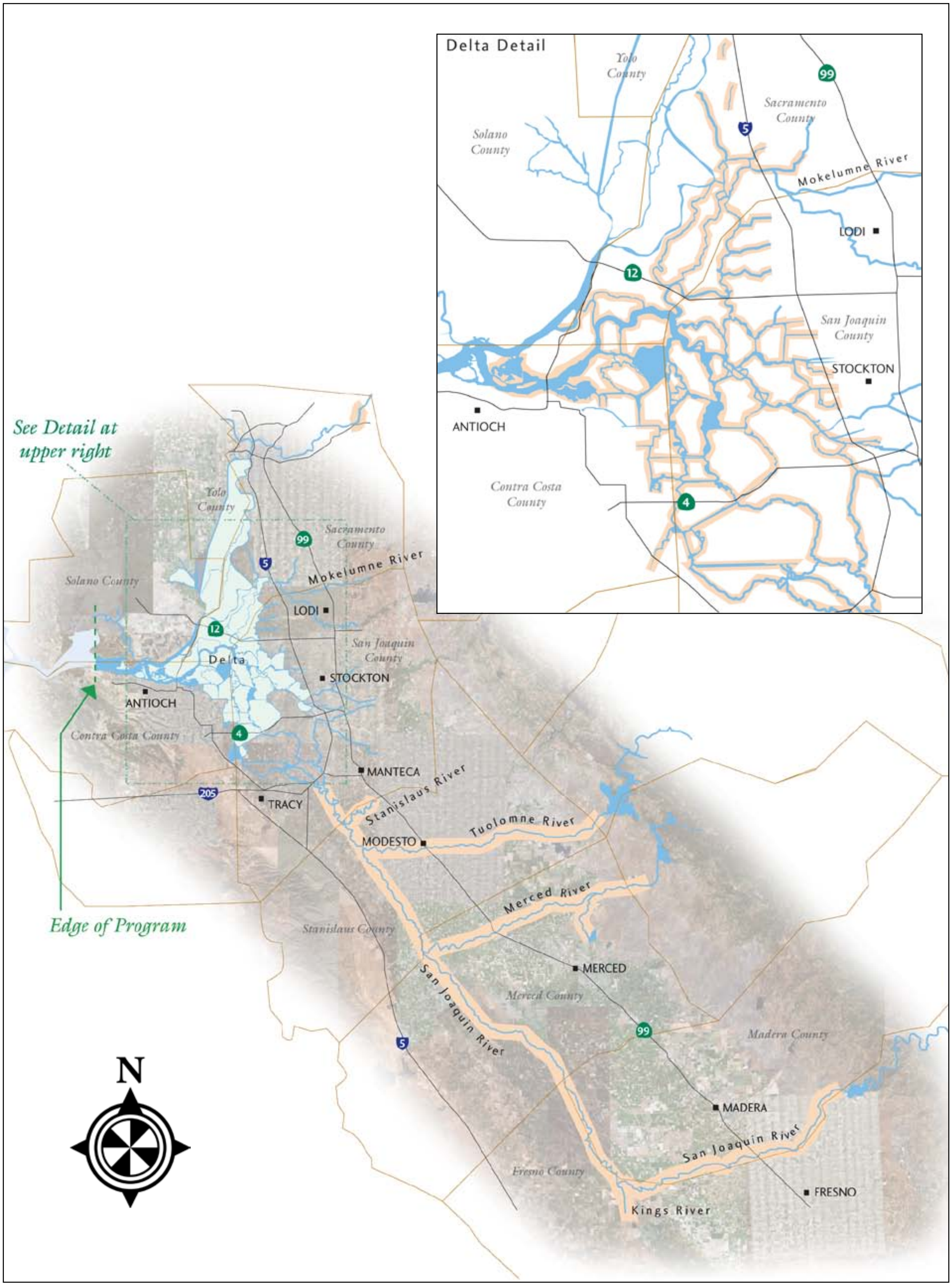
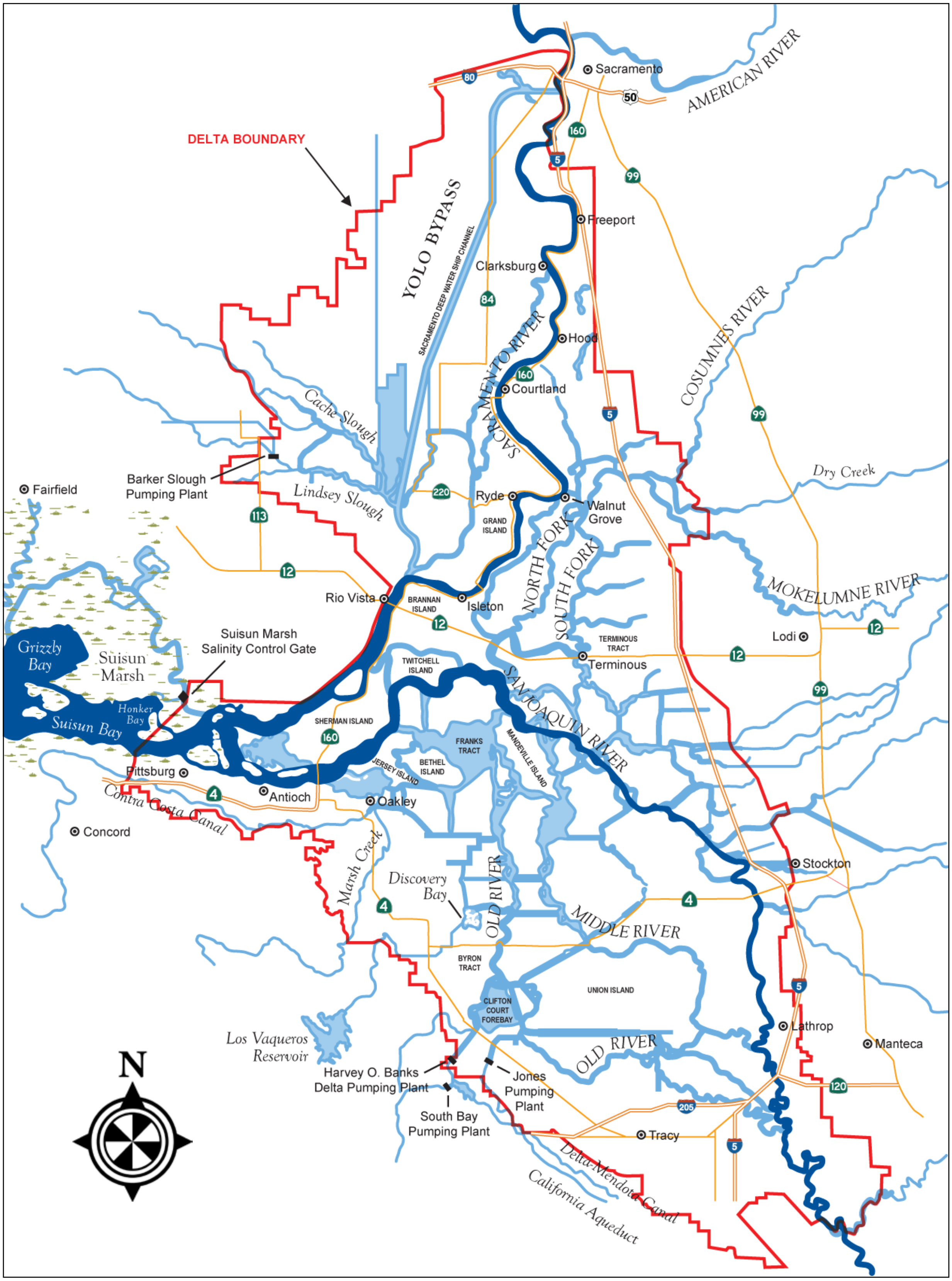


Exhibit 1-2
The Sacramento-San Joaquin Delta Legal Area



A. Organization of the WHCP Draft PEIR

The DBW, as the lead agency under the California Environmental Quality Act (CEQA), has prepared this Draft PEIR. This Draft PEIR satisfies the procedural, analytical, and public disclosure requirements of CEQA. The DBW has prepared this document pursuant to CEQA Guidelines (Title 14. California Code of Regulations, Section 15000 et. seq.). This Draft PEIR is a programmatic EIR, as defined in CEQA Guidelines, Section 15168.

This Draft PEIR is organized as follows:

Volume I – Chapters 1 to 7

- **Chapter 1: Introduction** – describes the organization and purpose of the Draft PEIR. This chapter also provides a history of the WHCP. The chapter includes the environmental factors checklist, followed by a discussion of "less than significant" and "no impact" environmental resource categories.
- **Chapter 2: Program Description and Program Alternatives** – provides a description of the WHCP locations, operations, permits, compliance, and monitoring. This chapter also describes project alternatives, including those that are not considered for further analysis.
- **Chapter 3: Biological Resources Impacts Assessment** – provides descriptions of the environmental setting, potentially significant impacts, and mitigation measures related to WHCP potential impacts on biological resources. This chapter includes discussions of potentially impacted special status species and critical habitats.
- **Chapter 4: Hazards and Hazardous Materials Impacts Assessment** – provides descriptions of the environmental setting, potentially significant impacts, and mitigation measures related to WHCP potential impacts on worker safety and hazardous materials in the environment.
- **Chapter 5: Hydrology and Water Quality Impacts Assessment** – provides descriptions of the environmental setting, potentially significant impacts, and mitigation measures related to WHCP potential impacts on water quality.
- **Chapter 6: Utilities and Service Systems and Agricultural Resources Impacts Assessments** – provides descriptions of the environmental setting, potentially significant impacts, and mitigation measures related to WHCP potential impacts on water utility intake pumps, agricultural crops, and agricultural irrigation pumps.
- **Chapter 7: Cumulative Impacts Assessment** – discusses the potential cumulative impacts of the WHCP when considered in combination with other projects and programs in the Delta.
- **References** – contains references used in the preparation of the Draft EIR.

Appendices – the following appendices provide additional information on the environmental review process, technical information that was used in the EIR analysis, and WHCP procedures.

Volume II – Appendices

- **Appendix A: WHCP Permits** – provides copies of the current WHCP National Pollutant Discharge Elimination System (NPDES) permit; and USFWS and NOAA-Fisheries Biological Opinions.
- **Appendix B: WHCP Herbicide Labels and Material Safety Data Sheets** – provides copies of labels and material safety data sheets for WHCP herbicides and adjuvants.
- **Appendix C: WHCP Operations Management Plan** – provides a detailed description of WHCP operations.
- **Appendix D: WHCP Fish Passage Protocol** – provides WHCP procedures to allow for fish passage during treatment.
- **Appendix E: WHCP Environmental Checklist** – provides a checklist reference that can be used by WHCP field workers to help implement the mitigation measures in this PEIR.

B. Purpose of the WHCP Draft PEIR

With preparation of this WHCP Draft PEIR, the DBW is updating environmental documentation for the WHCP. When the WHCP was initiated in the early 1980s, the federal and State agencies involved with the program determined that the WHCP did not require an EIR (or Environmental Impact Statement (EIS)).

The DBW's request, the U.S. Army Corps of Engineers provided the program's first formal environmental documentation in 1985. The Army Corps of Engineers prepared an "Environmental Assessment" and "Finding of No Significant Impact" (EA/FONSI) for the WHCP.

The DBW operated the WHCP with no additional environmental documentation until 1999. In 2000, DBW halted water hyacinth treatments in response to legal and regulatory changes.

Legal action from Delta Keepers claimed that the DBW needed a National Pollution Discharge Elimination System (NPDES) permit from the Central Valley Regional Water Quality Control Board (CVRWQB). The NPDES permit was required subsequent to the Talent decision (*Headwaters Inc. vs. Talent Irrigation District*, 2001), in which the 9th Circuit Court of Appeals ruled that aquatic herbicides and chemicals used by water agencies and other water body managers in ditches, canals, and other water bodies were not exempt from NPDES permitting requirements under the Clean Water Act.

Prior to restart of WHCP treatments in 2001, the DBW prepared a Biological Assessment of the WHCP, and obtained an NPDES permit and Section 7 Biological Opinions for the program. These permits required new environmental monitoring and compliance measures, which the DBW has been following since 2001. However, these permits are not as broad as an EIR, and do not provide the same environmental documentation that an EIR provides.

The WHCP has conducted extensive water quality monitoring, toxicity testing, and program evaluation over the last seven years. During this time, the DBW has not conducted a systematic effort to review and evaluate this new program data to analyze the environmental impacts of the WHCP. This Draft PEIR provides DBW with the opportunity to conduct such a review.

This Draft PEIR for the WHCP provides the DBW with the opportunity to carefully evaluate the program within the current context of the Delta environment and its current treatment practices. Much has changed in the Delta since the WHCP began in 1983. The list of threatened and endangered species has expanded, new (less toxic) aquatic herbicides and adjuvants have been added to the program, and there are significant new water quality and environmental concerns in the Delta.

Finally, this WHCP Draft PEIR provides environmental documentation parity with other newer aquatic invasive weed programs. Over the last several years, agencies implementing new aquatic invasive weed control programs in California have prepared EIRs:

- In 2001, the DBW prepared an EIR for the *Egeria densa* Control Program (EDCP)
- In 2003, the State Coastal Commission and U.S. Fish and Wildlife Service prepared an EIR/EIS for the Spartina Control Program
- In 2005, Lake County prepared a PEIR for their Clear Lake Integrated Aquatic Plant Management Plan.

There are three important characteristics of the WHCP which make it somewhat different from many projects or programs that require EIRs. First, like the three aquatic invasive weed programs identified above, the WHCP has long-term beneficial impacts. These beneficial impacts are in contrast to potential short-term detrimental impacts

Photo: Water hyacinth.

resulting from water hyacinth control alternatives. Discussions of the overall environmental impact of the WHCP must take into account trade-offs between potential short-term negative impacts and long-term positive impacts.

Second, the WHCP is a legislatively mandated State of California program. The Harbors and Navigation Code, Section 64, specifies that it is "necessary that the state, in cooperation with agencies of the United States, undertake an aggressive program for the effective control of water hyacinth and *Egeria densa* in the Delta, its tributaries, and the marsh [Suisun Marsh]." Section 64 further designates the DBW as the lead agency in controlling water hyacinth and *Egeria densa*. The WHCP was implemented in order to address problems created by water hyacinth in the Delta.

Third, the WHCP has been in operation for almost twenty-five years. The program was initiated in 1983, and has successfully operated each year since then, with the exception of 2000. During twenty-four years of WHCP operation without an EIR, the DBW has evaluated the program's environmental impacts, and analyzed various treatment methods.

C. History of the WHCP

In order to provide a perspective on WHCP operations and environmental impacts, this subsection describes the natural history of water hyacinth, and history of the WHCP.

1. Water Hyacinth in the Sacramento-San Joaquin Delta

Water Hyacinth Background

Water hyacinth (*Eichhornia crassipes*) is a non-native, invasive, free-floating aquatic macrophyte. Aquatic macrophytes are aquatic plants that are large enough to be apparent to the naked eye; in other words they are larger than most algae.

Water hyacinth is often noted in the literature as one of the world's most problematic weeds (Gopal 1987, Cohen and Carlton 1995, Batcher 2000, Lancar and Krake 2002). Native to the Amazon region of South America, it has spread to more than 50 countries on five continents. Water hyacinth creates significant problems in waterways and irrigation canals in Africa and Southeast Asia (Cohen and Carlton 1995, Lancar and Krake 2002).

Water hyacinth was introduced into the United States in 1884 at the Cotton States Exposition in New Orleans when display samples were distributed to visitors and extra plants were released into local waterways. By 1895, water hyacinth had spread across the Southeast and was growing in 40-km long mats that blocked navigation in the St. Johns River in Florida (Cohen and Carlton 1995).

The State of Florida was spending $6 million per year on invasive weed control, primarily water hyacinth, in the 1970s and 1980s (Rockwell 2003). In Fiscal Year 2006/2007, Florida's water hyacinth was in a maintenance control phase, requiring approximately $2 million per year to manage (Florida Department of Environmental Protection 2007).

The invasion of water hyacinth in California was slower than in the Southeast, probably due to water flow stabilization and the more temperate climate in the Delta (Toft 2000).Water hyacinth was first reported in California in 1904 in a Yolo County slough. It spread gradually for many decades, and was reported in Fresno and San Bernardino Counties in 1941 and in the Delta in the late 1940s and early 1950s. There were increased reports of water hyacinth in the Delta region during the 1970s, and by 1981, water hyacinth covered 1,000 acres of the Delta, and 150 of the 700 miles of waterways (U.S. Army Corps of Engineers 1985). Water hyacinth coverage estimates in the Delta since 1981 have ranged from approximately less than 500 acres up to approximately 2,500 acres. This wide range of annual water hyacinth acreage in the Delta is dependent on many factors including: acres treated, timing of treatments, winter air and water temperatures, summer air and water temperatures, water flow, and rainfall.

Water Hyacinth Natural History

Water hyacinth is characterized by showy lavender flowers and thick, highly glossy leaves up to ten inches across. These features have made water hyacinth a favorite in ornamental ponds and it can be readily purchased at aquatic nurseries. The plant grows from 1 ½ to 4 feet in height, and the floating portion of a single plant can grow to more than four feet in diameter. As much as 50 percent of a single water hyacinth's biomass can be roots, which extend to a depth of up to two feet in the water (Batcher 2000).

Water hyacinth grows in wetlands, marshes, shallow ponds, sluggish flowing waters, large lakes, reservoirs, and rivers (Batcher 2000). Water hyacinth often forms monospecific mats across sloughs and other waterways (Batcher 2000, Cohen and Carlton 1995). The mats are dispersed by winds and currents (Batcher 2000). In the Delta, water hyacinth is found in sloughs, connecting waterways, and tributary rivers. The growing season for water hyacinth in the Delta is typically from March to early December. Water hyacinth dies back or reduces growth during the cold winter months. However, the majority of plants do not die, and carry-over plants begin to grow in spring as the weather warms. Plants can tolerate extremes of water level fluctuation and seasonal variations in flow velocity, extremes of nutrient availability, pH, temperature, and toxic substances (Gopal 1987).

Water hyacinth requires freshwater. Water hyacinth will not survive in salinities greater than two parts per thousand (2ppt) (Wilson et al., 2001). Thus, water hyacinth infestations occur in those areas within the Delta with very low salinity. (Freshwater is defined as less than 3ppt, drinking water is less than 1ppt, brackish water is typically defined as between 3ppt and 35ppt, and seawater is 35ppt.) In the Delta, the line at which 2ppt salinity occurs, the X2, fluctuates with tidal levels and water outflow. The X2 line is typically located around Suisun Bay. As a result, water hyacinth generally does not grow in the western portions of the Delta, beyond this zone.

Over the long-term, water management practices in the Delta have reduced the natural variability in Delta salinity. Water exports and releases during the summer months reduce the inflow of San Francisco Bay waters, and maintain low levels of salinity suitable for drinking water and agriculture. This also improves growing conditions and habitat for water hyacinth and other invasive species.

Water hyacinth reproduces both vegetatively and sexually, although most reproduction is thought to be vegetative. In sexual reproduction, seeds may remain viable for up to twenty years, often sprouting along the muddy shorelines after a dry period, and dropping into the water with high tides (Batcher 2000). In vegetative reproduction, short runner stems (stolons) radiate from the base of the plant to form daughter plants (Batcher 2000).

Water hyacinth nursery areas include slow moving waterways, temporarily isolated oxbow lakes, tule stands along channel margins, and stagnant, dead-end sloughs. Small colonies of plants separate and form floating mats that drift downstream, infesting new areas. When water hyacinth extends into faster channels, or when higher flows occur, plants are torn away from their mats and moved by currents and wind until they encounter obstructions such as marinas, irrigation pumps, or backwater areas (U.S. Army Corps of Engineers 1985).

Water hyacinth spreads and grows rapidly under favorable temperature and nutrient conditions (warmer temperatures and higher nutrient levels). Water hyacinth mats weigh up to 200 tons per acre and its surface area may double in size from just six to fifteen days (Harley et al. 1996).

In a study comparing water hyacinth growth and temperature in the Sacramento San Joaquin Delta, Spencer and Ksander found that water hyacinth achieved maximum biomass in October (Spencer and Ksander 2005). This was later than expected, and later than in other regions of the country. Water hyacinth in the Delta increased in height from less than 10 cm in winter and early spring, to more than 80 cm in later summer (Spencer and Ksander 2005). New leaves began growing in March, and by August 7, leaves had reached 50 percent of their maximum leaf area (Spencer and Ksander 2005).

Concerns with Water Hyacinth

Water hyacinth displaces native aquatic plant and animal communities, causes substantial economic hardships, and interferes with water uses (Batcher 2000). Water hyacinth clogging Delta waterways and impeding navigation were an impetus for legislation in 1982 to establish the WHCP. Water hyacinth's negative impacts on ecosystems have only been understood more recently. Like other invasive species control programs, the WHCP must balance the cost of control, the impacts of control, and the benefits resulting from control. Below, we describe problems resulting from the spread of water hyacinth in the Delta.

Concerns Related to Boating and Recreation

In the 1970s and early 1980s, there were a growing number of complaints about water hyacinth by boaters and marina operators in the Delta (U.S. Army Corps of Engineers 1985). Delta marina operations lost an estimated $600,000 in 1981 due to unusable slips and launch ramps, reduced sales, increased rental boat repairs, and labor and equipment costs to deal with the water hyacinth problem according to the San Joaquin Delta Marina Association (U.S. Army Corps of Engineers 1985).

Water hyacinth clogs waterways and impedes navigation, presents a safety hazard to boating and water-skiing, and leads to hull damage when boats collide with obstructions hidden under water hyacinth (U.S. Army Corps of Engineers 1985). As water hyacinth spread in the Delta, many Delta boat harbors and marinas were forced to restrict operations because water hyacinth blocked facilities and damaged boats. Boats were unable to launch due to closed ramps and boat motors were damaged by overheating when water cooling systems become plugged with plant material. The houseboat rental industry and other marina businesses reported reductions in the use of their facilities due to water hyacinth (U.S. Army Corps of Engineers 1985).

After halting the control program in 2000 in response to the Delta Keepers lawsuit, the DBW received new complaints from marina operators

Photo: Water hyacinth coverage.

that were unable to launch boats and were losing revenues due to water hyacinth. Even now, in a typical year, the DBW fields numerous complaints concerning water hyacinth. The complaints, received during the spring and summer, are from both marina operators and residents in the Delta.

Without a coordinated effort by the DBW to treat water hyacinth, the potential presently exists for private citizens and marina operators to utilize their own control methods. These *ad hoc* treatments can result in: (1) potentially inappropriate selection of control methods that may not be efficacious; (2) improper application rates for aquatic herbicides; and (3) associated significant adverse impacts to fish, wildlife, and water quality.

The Army Corps of Engineers report also noted that water hyacinth interferes with swimming, fishing from banks in infested areas, and the aesthetic enjoyment of waterways. In addition, real estate values in areas adjacent to water hyacinth covered waterways are reduced (U.S. Army Corps of Engineers 1985).

Concerns Related to Ecosystems

The Delta ecosystem is a critically important part of California's natural environment and the ecological hub of the Central Valley. In addition, it is probably the most invaded ecosystem worldwide, with over 200 invasive non-native species (Cohen and Carlton 1995). Cohen and Carlton found that non-native species accounted for 40 to 100 percent of common species at many sites (Cohen and Carlton 1995).

Water hyacinth is labeled as an invasive habitat modifier. It provides a structurally complex canopy, with roots in the water column and leaves above water providing habitat for both native and non-native species. The CALFED Ecosystem Restoration Program Plan states that "these weeds [water hyacinth] are extremely dangerous because of their ability to displace native plant species, harm fish and wildlife, reduce foodweb productivity, or interfere with water conveyance and flood control systems" (CALFED Vol. 1 2000, p. 462). Similarly, the U.S. Fish and Wildlife Service (USFWS) notes that excessive water hyacinth growth outcompetes native vegetation and clogs waterways, impeding and impairing aquatic life (USFWS 1995).

The dense water hyacinth mats block sunlight, inhibiting photosynthesis in algae and submersed vascular plants (CALFED Vol. 1 ERP 2000, USFWS 1995). Water hyacinth increases sedimentation and accretion of organic matter, inhibits gaseous interchange with the air, reduces water flow, and depletes oxygen, all of which harm other aquatic organisms (CALFED Vol. 1 ERP 2000). In addition, organic fallout can influence the benthic zone (Toft 2000) and alter ecosystem processes such as nutrient cycling, hydrologic conditions, and water chemistry (CALFED Vol. 1 ERP 2000).

In the Stone Lakes National Wildlife Refuge in Sacramento County, the USFWS found that fish and wildlife habitat would be "greatly degraded or lost completely on shorelines, shallow water, and deepwater areas" if water hyacinth was allowed to grow unchecked (USFWS 1995). Even smaller infestations of water hyacinth along shorelines can prevent ducks, turtles, snakes, and frogs from seeking shelter (USFWS 1995).

Toft found significant differences in insect densities in water hyacinth and pennywort (a native aquatic plant), with increased taxa richness and diversity of invertebrates in pennywort in the early summer. While there were a greater number of species present in water hyacinth later in the summer, there were fewer native species (Toft 2000, Toft 2003).

Water hyacinth increases mosquito habitat by providing larval breeding sites where mosquito predators cannot reach (CALFED Vol. 1 2000), creating microhabitats for the vectors of malaria, encephalitis, schistosomiasis (USFWS 1995), and West Nile virus. Water hyacinth also competes with native plants, including Mason's lilaeopsis, a special status species (CALFED Vol. 1 ERP 2000).

Toft and others have found lower levels of dissolved oxygen under water hyacinth canopies. Average spot measures were below 5 mg/L in water hyacinth (the minimum level for fish survival) and above 5 mg/L in pennywort (Toft 2000). These results were supported by a study in Texas which found lower dissolved oxygen in water hyacinth compared to other aquatic weeds, and a University of California Davis study which found dissolved oxygen levels of as low as 0 mg/L below a solid water hyacinth mat (Toft 2000). Toft hypothesizes that the lower dissolved oxygen levels explain the absence of epibenthic amphipods and isopods beneath the water hyacinth canopy at one test site (Toft 2000, Toft 2003).

Concerns Related to Agriculture

Water hyacinth has significant negative impacts on agriculture and water conveyance systems in the Delta. The plant blocks pumping facilities, including those at the Delta Mendota Canal, the Tracy Pumping Plant, and the California Aqueduct near Clifton Court Forebay (U.S. Army Corps of Engineers 1985). In the early years of the control program, the Bureau of Reclamation estimated that the WHCP saved the Bureau $400,000 a year in reduced operating and maintenance costs associated with removing water hyacinth from just the Tracy Pumping Plant (DBW 1991).

Water hyacinth also interferes with pumping at numerous smaller water diversion structures. There are approximately 1,800 irrigation intakes throughout the Delta with the potential for clogging by water hyacinth, resulting in inefficient pumping, increased pumping costs, and possible mechanical failure of pumps. In a letter to the U.S. Army Corps of Engineers in 1981, the San Joaquin Farm Bureau Federation stated that growers were facing increased costs from efforts to open clogged channels where water hyacinth was decreasing the flow of water to pumps and clogging screens. Water hyacinth also spreads into irrigation and drainage systems (U.S. Army Corps of Engineers 1985), and impairs the use of fish protective devices such as fish screens (CALFED Vol. 1 ERP 2000).

2. Water Hyacinth Control Program (1983 to 1999)

Legislation and Start-Up

In 1982, Senate Bill 1344 amended the California Harbors and Navigation Code to designate the California Department of Boating and Waterways as the lead agency for controlling water hyacinth in the Delta, its tributaries, and the Suisun Marsh. Senate Bill 1344 was passed by the legislature and signed by Governor Deukmejian in response to the growing concern over problems created by water hyacinth.

The DBW established an interagency water hyacinth Task Force early on in the WHCP to coordinate the control activities of federal, state, and local interests and to resolve problems and concerns associated with public health and safety, and environmental impacts. The Task Force's primary role was to review results of the previous year's treatment program and to develop and approve the water hyacinth treatment protocol each year. **Table 1-1,** right, identifies agencies represented on the original task force.

Role of Participating Agencies

The DBW has served as the lead agency for local and federal water hyacinth control efforts. In 1981, the DBW asked the U.S. Army Corps of Engineers to assist in controlling water hyacinth in the Delta. In 1985, the Army Corps developed a State Design Memorandum on the Water Hyacinth for the Sacramento-San Joaquin Delta (U.S. Army Corps of Engineers 1985). The report described an operational plan for water hyacinth control based on the prior three years of DBW experience. The DBW was designated as the responsible agency for all control operations under the plan. The Army Corps completed a "Finding of No Significant Impact" (FONSI) for the program and obtained U.S. Fish and Wildlife Service approval in June 1985.[1]

In 1996, the U.S. Fish and Wildlife Service began management of the Stone Lakes Basin Water Hyacinth Control Group. The USFWS obtained approval for Pesticide Use Proposals for aerial and ground applications of 2,4-D and diquat and received an Intraservice Section 7 Evaluation. They have continued to treat Stone Lakes Basin in coordination with the DBW and several local agencies.

The Merced County Agricultural Commissioners Office began a treatment program for water hyacinth on the Merced and San Joaquin Rivers in Merced

[1] The FONSI was completed before the listing of several endangered fish species in the Delta.

Table 1-1
WHCP Original Multi-Agency Task Force Participants (circa 1983 to 2004)

Task Force Participants
California State Agencies
California Department of Boating and Waterways
California Department of Fish and Game
California Central Valley Regional Water Quality Control Board
California State Water Resources Control Board
California Department of Health Services
California Department of Food and Agriculture
California Department of Water Resources
Federal Agencies
U.S. Department of Agriculture – Agricultural Research Service
U.S. Army Corps of Engineers, Army Engineer Waterways Experiment Station
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service
Local Agencies
Contra Costa County Agricultural Commissioners Office
San Joaquin County Agricultural Commissioners Office
Fresno County Agricultural Commissioners Office
Solano County Agricultural Commissioners Office
Madera County Agricultural Commissioners Office
Merced County Agricultural Commissioners Office
Sacramento County Agricultural Commissioners Office
Stanislaus County Agricultural Commissioners Office
San Luis-Delta-Mendota Water Authority
Marina Recreation Association
Contra Costa Water District
Marina Owners and Operators
Sacramento Regional County Sanitation District.

Photo: Water hyacinth monitoring.

County in 1986. The DBW entered into a formal contract allowing the County to operate the treatment program within Merced County boundaries. By the mid-1990s, the County was able to reduce the amount sprayed to a control level. The DBW provided funding, equipment, materials, and technical support.

In 1996, the Fresno County Agricultural Commissioners Office entered into a similar contract with the DBW to implement a treatment program on the San Joaquin River and Kings River within Fresno County. During 1996, the County conducted surveys of water hyacinth on the San Joaquin River, and in 1997, initiated a treatment program of spraying and limited hand pulling. These affiliated programs followed the DBW Water Hyacinth Control Program protocol and DBW provided monitoring support.

The multi-agency Water Hyacinth Task Force met each year before the treatment season. This group had a significant impact on the design of the WHCP, as the DBW shaped protocols and treatment locations to help meet needs of the various member agencies. The role of the Task Force was less relevant after 2001, when the NPDES permit and biological opinion permits guided the program, and as a result, the Task Force stopped meeting in 2004. The DBW continues to work closely with various State, local, and federal agencies in implementing the WHCP.

Operations and Monitoring

The DBW initiated the WHCP in 1983. The program operated between March and December of each year until December 1999. Using an adaptive management approach, the DBW has revised and improved the WHCP since the program was initiated. This section provides an overview of the treatment program through 1999, including program description, program success, and program monitoring.

After conducting testing in 1982, the DBW treated approximately 500 acres of water hyacinth, primarily in the Central Delta, in 1983. The primary treatment consisted of spraying the systemic herbicide 2,4-D from a small boat using hand-held spray nozzles. The DBW and their partners followed treatment and monitoring protocols developed and approved each year by the Water Hyacinth Task Force.

The first several years of the WHCP focused on bringing water hyacinth under control in the Central Delta and enclosed water bodies. As these areas were controlled, the program focused on waterways in the West, North, and Southern Delta as well as three tributary rivers with severe water hyacinth problems (the San Joaquin, Tuolumne, and Merced Rivers).

The primary treatment method was chemical. Almost 97 percent of the treatment used 2,4-Dichlorophenoxyacetic acid, dimethylamine salt (2,4-D), with limited amounts of diquat and glyphosate used in special circumstances. While the DBW conducted some aerial and ground spraying, treatment typically was conducted with hand-held sprayers applied from 19 to 21 foot aluminum air or outboard motor boats. The boats were equipped for direct metering of herbicides, adjuvants, and water with mechanical pump systems. The pumps forced a mixture of the three components through a chemical resistant hose to a handheld spray gun. Trained field crews sprayed the chemical mixture directly onto the plants.

For the seventeen years between 1983 and 1999, the DBW treated between 160 and 2,700 acres of water hyacinth a year with no known measurable water quality or environmental degradation. Treatment levels varied depending on the number of crews available and the extent of water hyacinth infestation. For the first several years of the WHCP, the DBW had only one or two boat crews treating water hyacinth. Thus, the acres treated in those years were limited by boat crew time, not the amount of water hyacinth.

In the mid-1990s, the DBW was able to increase the number of its treatment crews. By increasing the number of crews, the DBW was able to treat a larger acreage of water hyacinth, and by 1999 the WHCP had reached the program's highest level of control.

If treatment had occurred in 2000, DBW estimated they would have only needed to treat about 200 acres in subsequent years. As water hyacinth was controlled, fewer acres required treatment each year, resulting in reduced herbicide use. **Table 1-2,** right, provides a summary of the acres treated and number of applications between 1983 and 1999.

In the early years of the program, the DBW systematically increased the treatment acres, first bringing the Central Delta and enclosed water bodies under control and then expanding treatment to the North, West, and then South Delta. The

Table 1-2
Historical WHCP Treatment Acreage (1983 to 1999)

	Year	Total Acres	Number of Applications
1	1983	507	
2	1984	244	98
3	1985	166	88
4	1986	227	93
5	1987	384	113
6	1988	633	114
7	1989	849	162
8	1990	699	141
9	1991	350	104
10	1992	798	129
11	1993	1,506	217
12	1994	2,743	287
13	1995	1,826	383
14	1996	2,051	685
15	1997	1,907	657
16	1998	2,434	1,117
17	1999	521	473

1985 WHCP summary report states that the program achieved at least a 99 percent control rate for those waterways east of Antioch, north of Mossdale, and south of Highway 12, the targeted control areas between 1983 and 1985 (DBW 1985).

In 1991, the DBW treated 350 acres in the Delta waterways, only half as much as the previous year (in part due to favorable weather for treating water hyacinth). Treatment in the Central Delta dropped from 492 acres in 1990 to 35 acres in 1991. As the DBW controlled areas such as the Central Delta, they were able to focus efforts on problem areas such as the San Joaquin and Tuolumne Rivers (DBW 1991).

In 1998, five two-person DBW crews concentrated their efforts in the North, West, and Central Delta, obtaining complete coverage within 12 weeks, considered a key milestone in establishing good control early in the season, allowing for a low maintenance control program the remainder of the season (DBW 1998).

In 1999, after several years of intensive treatment with four to five two-person crews, most sites needed only a low maintenance control program, and only 521 acres required treatment, about 20 percent of the previous year's treatment level (DBW 1999).

The original WHCP monitoring program was developed in 1982 by the DBW and Water Hyacinth Task Force members. A subcommittee of the task force developed a protocol for sampling and analysis that was jointly accepted by all participating agencies. The protocol included the adoption of specified methodologies for collecting and analyzing samples, quality control, and the use of split samples. The United States Department of Agriculture – Agricultural Research Service (USDA-ARS) sampled and analyzed pre- and post-treatment water samples for the DBW. The protocol included:

- Replicated sampling for 2,4-D before, and after, pesticide applications were conducted at a minimum of three locations, upstream, within, and downstream of the application site
- Additional sampling conducted at water outtakes near pesticide application areas
- Use of dye tracers with pesticide application to monitor the flow of water from the application site, with sampling conducted where any dye plume reached a water diversion within a two-hour period and at all water diversions within one mile of treatment.

Results of the first eight years of the WHCP monitoring showed very little chemical residue resulting from the program. The sampling protocol was followed between 1983 and 1990. During this time, levels of 2,4-D did not approach or exceed the federal maximum allowable level of 100 parts per billion (ppb). While conducting almost daily sampling at the fixed station site, the Tracy pumping plant had no detectable levels of 2,4-D in all but a few samples.

In 1991, the DBW and the Water Hyacinth Task Force determined that "the ability to control water hyacinth with 2,4-D and without any associated significant 2,4-D residues in Delta water has been established" (DBW 1991). The DBW and their partners stopped intensive daily monitoring and developed a new protocol that would document compliance with allowable levels of 2,4-D.

This 1991 protocol was implemented through 1999. The USDA-ARS conducted the monitoring until 1997. In 1998 and 1999, the California Department of Food and Agriculture Laboratory for Analytical Chemistry provided water sample collecting and analysis. Results were provided to the DBW weekly, or immediately if levels of 2,4-D exceeded criteria. The protocol included:

- Monitoring at three fixed stations: Tracy Pumping Plant, Oakley (Highway 4 and Contra Costa Canal), and the Antioch Water Intake. Samples were taken in duplicate at these stations Monday, Wednesday, and Friday morning. Samples were only obtained at the Antioch Water Intake when water was being pumped for potable use. Only samples taken on Monday and Friday were analyzed. Samples were stored for 30 days in the event that future analysis was needed
- Spot-checks of pesticide levels (pre- and post-monitoring as per the 1985 protocol) were taken once during the first two weeks of spring operations, and at any time if more than 3 contiguous acres were sprayed
- For fixed samples, the action criteria stated that if any duplicate samples averaged over 20 ppb 2,4-D, operations would be suspended until shown that contamination was not the result of operational spraying

Photo: Water hyacinth spraying.

Photo: Water hyacinth control program water sample laboratory analysis..

- For spot samples, if any duplicate post-treatment samples averaged over 50 ppb, operations would be suspended until adjustments were made to reduce levels below 50 ppb.

Between 1991 and 1999, the WHCP resulted in low to no detectable levels of 2,4-D in almost all samples. The vast majority of all samples tested fell below the detectable level of 2,4-D, 0.70 ppb. The highest level found in seven years of recorded analyses was 11.55 ppb, still well below the federal limit of 100 ppb and the state level of 20 ppb.

3. Water Hyacinth Control Program Transition Period (2000)

The DBW, Merced County, and Fresno County halted their control programs in 2000 after a legal action from the Delta Keepers claimed that the DBW must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the Central Valley Regional Water Quality Control Board (CVRWQCB) before discharging pesticides into Delta waterways.

The DBW applied for the NPDES permit in January 2000. The CVRWQCB developed proposed permit conditions for the WHCP; however, in October 2000, the CVRWQCB tabled the application, and the DBW petitioned the State Water Board for a judgment on NPDES appropriateness. In March 2001, the DBW received an individual NPDES permit for the program. Delta Keeper asked a Federal judge for summary judgment rather than take the dispute to trial, and in January 2001, the judge dismissed the case without prejudice.

During the 2000 WHCP hiatus, the DBW worked closely with State and federal agencies to prepare a Biological Assessment and obtain required permits for the program. These original permits (2000 and 2001), and updated versions subsequent, have guided much of the program's operations since the WHCP re-initiated treatments in 2001. We describe permit requirements and current program operations (i.e. 2001 to present) in Chapter 2: Program Description and Program Alternatives.

[i] The legal definition of the Sacramento-San Joaquin Delta is as follows. These boundaries are reflected in Exhibit 1-2. 12220. The Sacramento-San Joaquin Delta shall include all the lands within the area bounded as follows, and as shown on the attached map prepared by the Department of Water Resources titled "Sacramento-San Joaquin Delta," dated May 26, 1959:

Beginning at the Sacramento River at the I Street bridge proceeding westerly along the Southern Pacific Railroad to its intersection with the west levee of the Yolo By-Pass; southerly along the west levee to an intersection with Putah Creek, then westerly along the left bank of Putah Creek to an intersection with the north-south section line dividing sections 29 and 28, T8N, R6E; south along this section line to the northeast corner of section 5, T7N, R3E; west to the northwest corner of said section; south along west boundary of said section to intersection of Reclamation District No. 2068 boundary at northeast corner of SE 1/4 of section 7, T7N, R3E; southwesterly along Reclamation District No. 2068 boundary to southeast corner of SW 1/4 of section 8, T6N, R2E; west to intersection of Maine Prairie Water Association boundary at southeast corner of SW 1/4 of section 7, T6N, R2E; along the Maine Prairie Water Association boundary around the northern and western sides to an intersection with the southeast corner of section 6, T5N, R2E; west to the southwest corner of the SE 1/4 of said section; south to the southwest corner of the NE 1/4 of section 7, T5N, R2E; east to the southeast corner of the NE 1/4 of said section; south to the southeast corner of said section; west to the northeast corner of section 13, T5N, R1E; south to the southeast corner of said section; west to the northwest corner of the NE 1/4 of section 23, T5N, R1E; south to the southwest corner of the NE 1/4 of said section; west to the northwest corner of the SW 1/4 of said section; south to the southwest corner of the NW 1/4 of section 26, T5N, R1E; east to the northeast corner of the SE 1/4 of section 25, T5N, R1E; south to the southeast corner of said section; east to the northeast corner of section 31, T5N, R2E; south to the southeast corner of the NE 1/4 of said section; east to the northeast corner of the SE 1/4 of section 32, T5N, R2E; south to the northwest corner of section 4, T4N, R2E; east to the northeast corner of said section; south to the southwest corner of the NW 1/4 of section 3, T4N, R2E; east to the northeast corner of the SE1/4 of said section; south to the southwest corner of the NW 1/4 of the NW 1/4 of section 11, T4N, R2E; east to the southeast corner of the NE 1/4 of the NE 1/4 of said section; south along the east line of section 11, T4N, R2E to a road intersection approximately 1000 feet south of the southeast corner of said section; southeasterly along an unnamed road to its intersection with the right bank of the Sacramento River about 0.7 mile upstream from the Rio Vista bridge; southwesterly along the right bank of the Sacramento River to the northern boundary of section 28, T3N, R2E; westerly along the northern boundary of sections 28, 29, and 30, T3N, R2E and sections 25 and extended 26, T3N, R1E to the northwest corner of extended section 26, T3N, R1E; northerly along the west boundary of section 23, T3N, R1E to the northwest corner of said section; westerly along the northern boundary of sections 22 and 21, T3N, R1E to the Sacramento Northern Railroad; southerly along the Sacramento Northern Railroad; southerly along the Sacramento Northern Railroad to the ferry slip on Chipps Island; across the Sacramento River to the Mallard Slough pumping plant intake channel of the California Water Service Company; southward along the west bank of the intake channel and along an unnamed creek flowing from Lawler Ravine to the southern boundary of the Contra Costa County Water District; easterly along the southern boundary of the Contra Costa County Water District to the East Contra Costa Irrigation District boundary; southeasterly along the southwestern boundaries of the East Contra Costa Irrigation District, Byron-Bethany Irrigation District, West Side Irrigation District and Banta-Carbona Irrigation District to the northeast corner of the NW 1/4 of section 9, T3S, R6E; east along Linne Road to Kasson Road; southeasterly along Kasson Road to Durham Ferry Road; easterly along Durham Ferry Road to its intersection with the right bank of the San Joaquin River at Reclamation District No. 2064; southeasterly along Reclamation District No. 2064 boundary, around its eastern side to Reclamation District No. 2075 and along the eastern and northern sides of Reclamation District No. 2075 to its intersection with the Durham Ferry Road; north along the Durham Ferry Road to its intersection with Reclamation District No. 17; along the eastern side of Reclamation District No. 17 to French Camp Slough; northerly along French Camp Turnpike to Center Street; north along Center Street to Weber Avenue; east along Weber Avenue to El Dorado Street; north along El Dorado Street to Harding Way; west along Harding Way to Pacific Avenue; north along Pacific Avenue to the Calaveras River; easterly along the left bank of the Calaveras River to a point approximately 1,600 feet west of the intersection of the Western Pacific Railroad and the left bank of said river; across the Calaveras River and then north 18* 26' 36 west a distance of approximately 2,870 feet; south 72* 50' west a distance of approximately 4,500 feet to Pacific Avenue (Thornton Road); north along Pacific Avenue continuing onto Thornton Road to its intersection with the boundary line dividing Woodbridge Irrigation District and Reclamation District No. 348; east along this boundary line to its intersection with the Mokelumne River; continuing easterly along the right bank of the Mokelumne River to an intersection with the range line dividing R5E and R6E; north along this range line to the Sacramento-San Joaquin County line; west along the county line to an intersection with Reclamation District No. 1609; northerly along the eastern boundary of Reclamation District No. 1609 to the Cosumnes River, upstream along the right bank of the Cosumnes River to an intersection with the eastern boundary of extended section 23, T5N, R5E; north along the eastern boundary of said extended section to the southeast corner of the NE 1/4 of the NE 1/4 of said extended section; west to the southeast corner of the NE 1/4 of the NW 1/4 of extended section 14, T5N, R5E; west to an intersection with Desmond Road; north along Desmond Road to Wilder-Ferguson Road; west along Wilder-Ferguson Road to the Western Pacific Railroad; north along the Western Pacific Railroad to the boundary of the Elk Grove Irrigation District on the southerly boundary of the N 1/2 of section 4, T5N, R5E; northerly along the western boundary of the Elk Grove Irrigation District to Florin Road; west on Florin Road to the eastern boundary of Reclamation District No. 673; northerly around Reclamation District No. 673 to an intersection with the Sacramento River and then north along the left bank of the Sacramento River to I Street bridge. Section, range, and township locations are referenced to the Mount Diablo Base Line and Meridian. Road names and locations are as shown on the following United States Geological Survey Quadrangles, 7.5 minute series: Rio Vista, 1953; Clayton, 1953; Vernalis, 1952; Ripon, 1952; Bruceville, 1953; Florin, 1953; and Stockton West, 1952.