Chapter 3

Environmental Impacts of the EDCP

Introduction

This chapter describes potential environmental impacts of the EDCP to resources of the Sacramento-San Joaquin Delta. The chapter is organized in sections corresponding to the sixteen (16) general resource categories identified in the Environmental Checklist, located prior to Chapter 1. Baseline information on these general resources is presented in Chapter 2 (Environmental Setting) and referenced throughout this chapter.

Potential environmental impacts of the Two-Year Komeen Trials are discussed in Chapter 4. None of the impacts associated with the Two-Year Komeen Trials are described in this chapter.

Chapter Organization

Each of the chapter's 16 sections contain the following information, unless no project-related impacts are expected to occur:

Introduction: A brief overview of the discussion focus is presented.

Significance Threshold: The criteria used to determine whether an impact is above or below a threshold of significance is presented. In some cases, these criteria are quantifiable standards, while in others the criteria are more qualitative.

Environmental Impacts/Consequences: An assessment of the specific environmental impacts potentially resulting from project operations is presented. The discussion of impacts utilizes findings from the EDCP research trials, technical information from scientific literature on environmental toxicology and ecology, and relevant information on public policies, such as water quality standards. Impact assessments are based on this technical and scientific information.

Where possible, an effort is made to quantify the extent of the impacts, (e.g. persistence of herbicide in the water column over time; approximate percentage of vegetation remaining in treatment area following herbicide application). However, in many instances, it was not possible to quantify the extent of a particular impact accurately. In such cases, the analysis is primarily qualitative.

Significance Determination: For each impact assessed, a determination is made as to significance level. Potential impacts are categorized as one of the following:

Unavoidable significant impact: where the environmental effect of the proposed project reaches the threshold of significance but no feasible mitigation is available to reduce the impact to a less-than-significant level. If available, measures are proposed that lessen the significance of the impact.

Unavoidable potentially significant impact: where available evidence suggests, but is not sufficient to determine conclusively, that a significant impact is unavoidable. If available, measures are proposed that lessen the significance of the impact.

Avoidable significant impact: where the environmental effect of the proposed project reaches the threshold of significance, but feasible mitigation measures are available to reduce the impact to a less-than-significant level.

Less than significant impact: where the environmental effect of the proposed project does not reach the threshold of significance. No mitigation is necessary.

No impact: where the environmental effect of the proposed project would not result in any impact.

Mitigation: Specific mitigation measures proposed by the DBW to avoid or minimize potential impacts are presented. Mitigation measures refer to measures taken to avoid and/or minimize adverse impacts. The discussion will indicate if no mitigation measures are available.

The DBW has and will continue to undergo consultation with various State and federal agencies, including USFWS, CDFG, NMFS, CVRWQCB regarding impacts and mitigation measures. Proposed mitigation measures may be revised and/or additional mitigation measures incorporated as a result of this consultation process.

Where no impacts are expected to occur to a resource, the section contains a brief statement explaining the basis of this determination.

Overview of Impacts

Exhibit 3-1, on the following page, summarizes impacts of the EDCP at the general resource category level. As shown in **Exhibit 3-2**, following Exhibit 3-1, the EDCP would result in unavoidable significant impacts, or avoidable significant impacts, to the following general resource categories noted below with chapter reference:

Hydrology and Water Quality	3.1
Biological Resources	3.2
Agricultural Resources	3.3
Utilities and Public Service Systems	3.4
Hazardous and Hazardous Materials	3.5

The EDCP would result in less than significant impacts to the following general resource categories:

Transportation and Traffic	3.6
Recreation	3.7
Air Quality	3.8
Mineral Resources	3.9
Noise	3.10
Geology and Soils	3.11

The EDCP would not impact the following general resource categories:

Land Use and Planning	3.12
Public Services	3.13
Population and Housing	3.14
Cultural Resources	3.15
Aesthetics	3.16.

EXHIBIT 3-1

Environmental Impacts of the EDCP
(Listed by General Resource Category)

No.	Resource Categories	EDCP Impacts[a]
	Potentially Significant Impacts	
1.	**Hydrology and Water Quality**	**USI**
	Water Quality	
	Toxicity	USI
	Dissolved Oxygen	ASI
	Sediments	LSI
	Turbidity	USI
	Floating Material	ASI
	Water Quality	*USI*
	Drinking Water	
	Chemical Constituents	ASI
	THM Formulation	ASI
	Turbidity	ASI
	Drinking Water	*ASI*
2.	**Biological Resources**	**USI**
	Plants	
	Native Aquatic Plants and Algae	LSI
	Intertidal Wetland Plant Communities	USI
	Terrestrial Plants	NI
	Plants	*USI*
	Invertebrates	
	Aquatic	USI
	Insects	ASI
	Invertebrates	*USI*
	Fish	
	Fish	USI
	Habitat	ASI
	Prey Base	USI
	Fish	*USI*
	Wildlife	
	Reptiles and Amphibians	USI
	Birds	USI
	Mammals	LSI
	Wildlife	*USI*
3.	**Agricultural Resources**	**ASI**
	Agricultural Operations, Irrigation	ASI
4.	**Utilities and Service Systems**	**ASI**
	Public Water Supply Operations	ASI
5.	**Hazards and Hazardous Materials**	**ASI**
	Human Health	ASI
	Catastrophic Spills	ASI

No.	Resource Categories	EDCP Impacts
	Less Than Significant Impacts/No Impacts	
6.	**Transportation and Traffic**	**LSI**
7.	**Recreation**	**LSI**
8.	**Air Quality**	**LSI**
9.	**Mineral Resources**	**LSI**
10.	**Noise**	**LSI**
11.	**Geology and Soils**	**LSI**
12.	**Land Use and Planning**	**NI**
13.	**Public Services**	**NI**
14.	**Population and Housing**	**NI**
15.	**Cultural Resources**	**NI**
16.	**Aesthetics**	**NI**

Legend

LSI: Less Than Significant Impact
ASI: Avoidable Significant Impact
USI: Unavoidable Significant Impact
NI: No Impact

a) Prior to any proposed mitigation measures.

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Environmental Impacts of the EDCP
(Listed by General Resource Category)

No.	Resource Categories	Impact Significance Prior to Mitigation	Explanation of Impact	Proposed Mitigation Measures	Impact Significance Post Mitigation
1	**Hydrology and Water Quality**				
	General Water Quality				
	Toxicity	Unavoidable Significant Impact	Reward and Sonar use conflict with the Basin Plan standards regarding toxicity, which state that Delta waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.	No mitigation available	Unavoidable Significant Impact
	Dissolved Oxygen (DO)	Avoidable Significant Impact	Reward use could result in a short-term, localized reduction in DO to concentrations that are less than the numeric standards specified in the Basin Plan.	Prior to any herbicide treatment, the DBW would measure DO concentration at treatment site. If concentrations were less than 5 ppm, treatment would be postponed until levels increased above this limit. The DBW would treat no more than 20 acres per day at a given treatment site. During late summer and fall (when DO in the hypolimnion is typically lowest), no more than 20 acres would be treated at a given treatment site over a 14-day period.	Less than Significant Impact
	Sediments	Less than Significant Impact	Reward is not biologically available once it reaches the sediments and will degrade over time.	No mitigation necessary.	Less than Significant Impact
	Turbidity	Unavoidable Significant Impact	Mechanical harvester maneuvering can cause temporary localized increases in turbidity.	No mitigation available.	Unavoidable Significant Impact
	Floating Material	Avoidable Significant Impact	Plant fragments generated during mechanical harvesting can become a nuisance if a substantial quantity of fragments remain uncollected.	A fragment collection vessel would follow each mechanical harvester operating at a treatment site. The DBW would not conduct harvesting on extremely windy days.	Less than Significant Impact
	Drinking Water Quality				
	Chemical Constituents	Avoidable Significant Impact	Reward treatments that occur near water treatment facility intakes could adversely impact drinking water supplies if an influx of herbicide-treated water contaminated drinking water supplies.	At least, two weeks prior to treatments, the DBW would contact appropriate drinking water utilities and the CA Department of Health Services to inform them that treatment is to occur. The DBW would establish a one mile buffer zone around water treatment facility intakes within which herbicide application would not occur without consultation and agreement from the water agency. If required, in addition to regular monitoring activities (measurements of DO, herbicide residues, turbidity, etc.), the DBW would consult with the DHS to coordinate monitoring of BOD, TOC, DOC, and UVA-254 as necessary.	Less than Significant Impact
	Trihalomethane Formulation	Avoidable Significant Impact	Herbicide treatments that occur near water treatment facility intakes could increase the potential for THM formation due to the increase in dissolved organic compounds released from decaying plant material.	Same as for Drinking Water Quality-Chemical Constituents above.	Less than Significant Impact
	Turbidity	Avoidable Significant Impact	Mechanical harvesting near water treatment plant intakes could temporarily increase turbidity levels.	Same as for Drinking Water Quality-Chemical Constituents above.	Less than Significant Impact

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Environmental Impacts of the EDCP
(Listed by General Resource Category)

No.	Resource Categories	Impact Significance Prior to Mitigation	Explanation of Impact	Proposed Mitigation Measures	Impact Significance Post Mitigation
2	**Biological Resources**				
	Plants				
	Native Aquatic Plants and Algae	Less than Significant Impact	Loss of native aquatic plants would be minimal since treatment is focused on sites with a high relative abundance (approximately 85 percent) of *Egeria*. Further, removal of *Egeria* would create new habitat for native aquatic plants. Algae would not be impacted by Sonar treatments or mechanical harvesting. Treatment with Reward may result in short-term, localized decreases in algal abundance. However, algal abundance would be expected to rebound rapidly due to redistribution of algal cells by water flow. Further, increases in light penetration in the water column following removal of *Egeria* would facilitate algal growth.	No mitigation necessary.	Less than Significant Impact
	Intertidal Wetland Plant Communities	Unavoidable Significant Impact	Wetland and special status Intertidal plants could be adversely impacted or killed due to inundation by herbicides or staging of mechanical harvesting equipment. These special status plants include Mason's lilaeopsis, Delta mudwort, Rose mallow, Delta tule pea, and Northern California black walnut. Wetland plants include tules and cattails.	Prior to an herbicide application, channel banks would be surveyed by a qualified botanist to determine whether sensitive plant species are present. If the site has a high percentage of sensitive plants, the site may not be treated. If possible, herbicide applications would occur during low tide to decrease the likelihood that sensitive plants would be inundated by herbicide-treated water. Herbicide applications would focus on the mid-channel region to decrease the possibility that concentrated herbicides would come in contact with sensitive plants growing along channel banks. Following herbicide treatment, channel banks would be surveyed to determine whether a loss of sensitive plants has occurred. If substantial loss is evident, changes would be made to the treatment protocol. Prior to mechanical harvesting, channel banks would be surveyed. The area around any sensitive plants would be flagged and no staging, or movement of harvester equipment, would be allowed within the flagged area.	Unavoidable Significant Impact
	Terrestrial Plants	No impact	Project operations would not affect plants that occur upland of channel banks. Further, disposal of harvested *Egeria* would occur on fallow agricultural land, and thus would not impact any sensitive plant species.	No mitigation necessary.	No impact

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Environmental Impacts of the EDCP
(Listed by General Resource Category)

No.	Resource Categories	Impact Significance Prior to Mitigation	Explanation of Impact	Proposed Mitigation Measures	Impact Significance Post Mitigation
	Invertebrates				
	Aquatic Invertebrates	Unavoidable Significant Impact	Reward and mechanical harvesting could cause a temporary decrease in the abundance of invertebrates. Reward is moderately toxic to aquatic invertebrates and mechanical harvesting can result in their removal and physical destruction. The decrease in invertebrate abundance would likely be temporary. It is expected that planktonic invertebrates would be reintroduced to treatment areas inadvertently through water flow. Further, benthic and plant-dwelling organisms likely would recolonize treatment areas relatively rapidly once regrowth of plants began.	No more than 20 acres would be treated with Reward on any given day in a given treatment site. For treatment sites larger than 20 acres, upstream portions would be treated first, and downstream portions would be treated at least 14 days later. Mechanical harvesting sites would be no larger than 10 acres in size. Harvesters would not cut vegetation more than five feet below water level, thus leaving one to three feet of standing vegetation. These measures would decrease the overall loss of invertebrates and would minimize impediments to recolonization.	Unavoidable Significant Impact
	Insects	Avoidable Significant Impact	EDCP operations could harm the Valley elderberry longhorn beetles if project operations adversely impacted elderberry shrubs.	Prior to treatment, surveys would be conducted to determine whether sensitive species are present. EDCP treatments would not occur along channel bluffs where eldeberry shrubs could be adversely impacted.	Less Than Significant Impact
	Fish				
	Fish: Direct Impacts	Unavoidable Significant Impact	Mechanical harvesting can result in the removal and physical destruction of fish present in *Egeria* beds. Special status species that could be impacted include all four runs of chinook salmon, steelhead, delta smelt, splittail, green sturgeon, longfin smelt, and Pacific River lamprey. Reward and Sonar use would have no direct adverse impacts on fish.	All requirements identified by the regulatory agencies, such as the USFWS, NMFS, and CDFG, would be adhered to. These could involve, for example, suspension of harvesting operation for specific periods of time to avoid disrupting fish migration or spawning, or avoiding certain habitat conditions. Prior to mechanical harvesting, IEP Real Time Monitoring data would be obtained and evaluated (if available and relevant to the project site) to determine whether any sensitive fish species had been identified in the treatment area. If required by regulatory agencies, a pretreatment fish survey following the protocol for pop-net use established by McGowan (1998) would be conducted by a qualified biologist one to two days prior to commencement of treatment. If the number of special status fish identified through IEP data or pop-net surveys were above a certain threshold level, treatment would be postponed until additional surveys indicated fewer sensitive fish were present in the area. The threshold level would be established through consultation with the appropriate regulatory agencies. For the first two years of the EDCP, a representative sample of the harvested material would be examined by a qualified biologist to assess any incidental taking of threatened, endangered or special status species. This information would be reported to the appropriate regulatory agencies and adjustments to program protocol could be made in order to minimize impacts.	Unavoidable Significant Impact

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Environmental Impacts of the EDCP
(Listed by General Resource Category)

No.	Resource Categories	Impact Significance Prior to Mitigation	Explanation of Impact	Proposed Mitigation Measures	Impact Significance Post Mitigation
	Indirect Impacts to Fish: Habitat	Avoidable Significant Impact	Reward use could result in a short-term, localized reduction in DO to concentrations that could adversely impact the habitat of the special status fish species listed above. Loss of native vegetation due to EDCP project activities would be a less than significant impact, since treatments would focus on sites with a high relative abundance of *Egeria*.	Same as for General Water Quality - Dissolved Oxygen above.	Less than Significant Impact
	Indirect Impacts to Fish: Prey Base	Unavoidable Significant Impact	Reward use and mechanical harvesting could cause a temporary decrease in the abundance of aquatic invertebrates, which could adversely impact special status fish species such as chinook salmon, delta smelt and splittail that consume these invertebrates.	Same as for Biological Resources– Invertebrates above.	Unavoidable Significant Impact
	Wildlife				
	Reptiles and Amphibians	Unavoidable Significant Impact	Reward and Sonar use could adversely impact reptiles and amphibians that utilize channels and channel banks in the Delta, including special status species such as the giant garter snake, western pond turtle, and red-legged frog. Mechanical harvesting operations and staging of equipment could kill or maim individuals in channels or on channel banks.	Prior to mechanical harvesting, channel banks and uplands adjacent to treatment sites would be surveyed by a qualified biologist to asses whether sensitive species are present. Areas which show presence of sensitive species (e.g., nests or burrows) or which exhibit ideal habitat conditions for a particular sensitive species would be flagged. No mechanical harvesting equipment would be allowed within 50 feet of these flagged areas. There is no mitigation for impacts to reptiles and amphibians resulting from Reward and Sonar.	Unavoidable Significant Impact
	Birds	Unavoidable Significant Impacts	Reward or Sonar use could adversely impact birds that nest or forage on channel banks, since the herbicide could kill channel bank vegetation. Mechanical harvesting could adversely impact birds that nest or forage along channel banks due to staging of mechanical harvesting equipment. Special status species that could be impacted include the California black rail and great blue heron.	Same as for Biological Resources– Plants (Wetland, Intertidal and Riparian Plant Communities, and Wildlife - Reptiles and Amphibians).	Unavoidable Significant Impacts
	Mammals	Less Than Significant Impact	Exposure of mammals to EDCP activities is expected to be minimal. The only special status mammal species that utilize sloughs and channels of the Delta are the Small-footed myotis bat and Yuma myotis bat, which forage over the water. However, they are not expected to be impacted because EDCP activities would not affect their insect prey.	No mitigation necessary.	Less Than Significant Impact

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Environmental Impacts of the EDCP
(Listed by General Resource Category)

No.	Resource Categories	Impact Significance Prior to Mitigation	Explanation of Impact	Proposed Mitigation Measures	Impact Significance Post Mitigation
3	**Agricultural Resources**				
	Agricultural Operations, Irrigation	Avoidable Significant Impact	Reward and Sonar use could adversely impact crops if herbicide-treated water were used for irrigation. Mechanical harvesting could disrupt irrigation if plant fragments clogged irrigation intakes.	Prior to beginning EDCP treatments (herbicide or mechanical) that are to occur near agricultural intakes, the appropriate County Agricultural Commissioner's Office would be consulted. Local landowners could then be informed of the particular periods of time during which irrigation should not occur and when it is safe to begin irrigation. Post-treatment monitoring would include measurement of herbicide residues in the water column and a site check for *Egeria* fragments in intake pipes.	Less Than Significant Impact
4	**Utilities and Service Systems**				
	Public Water Supply Operations	Avoidable Significant Impact	An increase in debris load due to decaying plant material, or plant fragments could adversely impact public water supply operations by clogging intake screens or pumps.	The DBW would establish a one-mile buffer zone around water treatment intakes. No herbicide application or mechanical harvesting would occur within that buffer zone without consultation and agreement from the appropriate water agencies.	Less Than Significant Impact
5	**Hazardous and Hazardous Materials**				
	Human Health	Avoidable Significant Impact	Reward use could adversely impact drinking water supplies as described above under Drinking Water Quality-Chemical Constituents. Impacts to human health could also result from exposure to concentrated formulations of reward and Sonar.	Impacts to drinking water supplies would be avoided through mitigation measures described above under Drinking Water Quality-Chemical Constituents. Prior to treatments, marina and dock owners would be notified regarding timing of treatments. During herbicide treatments, sites would be marked with buoys. Additionally, DBW staff would patrol treatment areas on a support boat, informing recreators that treatments are occurring. Handling of concentrated chemicals would follow the protocol identified in "Herbicide Handling Procedures and Spill Contingency Plan" (Appendix S).	Less Than Significant Impact
	Catastrophic Spills	Avoidable Significant Impact	A catastrophic spill of Reward or Sonar could result in adverse impacts to aquatic, wetland and intertidal habitat and associated flora and fauna, including special status species. Adverse impacts to human health could occur also due to exposure to concentrated herbicide formulations. The degree of harm would depend on the amount of chemical spilled, environmental conditions (flow, tidal action), and emergency response time.	Avoidance and mitigation measures are contained in "Herbicide Handling Procedures and Spill Contingency Plan" (Appendix S).	Less Than Significant Impact

3.1 Hydrology and Water Quality

This section assesses potential impacts to Delta water quality resulting from the EDCP. Exhibit 3-2 summarizes water quality impacts, proposed mitigation measures, and the significance of the water quality impact both pre- and post-mitigation. Baseline information on Delta water is presented in Section 2.1 of Chapter 2. There are no expected impacts to hydrology from the proposed EDCP, thus this section addresses water quality impacts only.

CEQA Guidelines indicate that a project may significantly impact water quality if it:

- Substantially degrades water quality;
- Results in a discharge into surface waters or alters surface water quality (e.g., temperature, dissolved oxygen, or turbidity);
- Conflicts with adopted community goals and environmental plans; or
- Contaminates a public water supply.

This section is divided into two water quality categories:

- *General Water Quality* (Section 3.1.1) - impacts to water quality that affect overall ecosystem health, including the potential for EDCP activities to:
  - Contribute toxic constituents to water
  - Reduce dissolved oxygen levels
  - Contribute toxic constituents to sediments
  - Increase turbidity
  - Increase floating material.
- *Drinking Water Quality* (Section 3.1.2) - impacts to water quality that could affect drinking water supplies, including the potential for EDCP activities to result in the following effects to drinking water supplies:
  - Contribute adverse chemical constituents
  - Increase the potential for trihalomethane (THM) formation
  - Increase turbidity.

3.1.1 General Water Quality

Herbicide treatments and mechanical harvesting could potentially impact general water quality at EDCP sites. Herbicide treatments could adversely impact general water quality by increasing the concentration of toxic chemical constituents in the water column or sediments, or by reducing dissolved oxygen levels. Mechanical harvesting could adversely impact general water quality by increasing turbidity and floating material (i.e., plant fragments) in the water column.

3.1.1.1 General Water Quality Significance Threshold

Criteria used to assess general water quality impacts are the water quality standards established and enforced by the Central Valley Regional Water Quality Control Board (CVRWQCB), one of nine regional water quality control boards in California. The CVRWQCB established the Water Quality Control Plan for the Central Valley Region (hereafter referred to as the "Basin Plan"). The Basin Plan sets forth water quality standards (also referred to as "objectives") that aim to preserve and enhance Sacramento-San Joaquin Delta water quality for the benefit of present and future generations. Basin Plan standards are overseen and enforced by the CVRWQCB.

The following five Basin Plan standards were used to assess general water quality impacts: 1) toxicity in the water column, 2) dissolved oxygen, 3) pesticide concentrations in the sediments, 4) floating material, and 5) turbidity. A description of each of these five standards is provided in **Exhibit 3-3**, on the following page.

3.1.1.2 Environmental Impacts/Consequences of the EDCP to General Water Quality

The discussion of general water quality impacts is divided into five topics.

- 3.1.1.2.1 Toxicity of EDCP Methods
- 3.1.1.2.2 Impact of EDCP Methods on Dissolved Oxygen Levels
- 3.1.1.2.3 Sediments
- 3.1.1.2.4 Floating Material
- 3.1.1.2.5 Turbidity.

These five topics follow the five Basin Plan standards identified above.

EXHIBIT 3-3

Basin Plan Standards

Water Quality Standard	Description of Water Quality Standard
Toxicity	"All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal or aquatic life."
Pesticides[a]	"Discharges shall not result in pesticide concentrations in bottom sediments…that adversely affect beneficial uses."[b]
Dissolved Oxygen	"Within the legal boundaries of the Delta, the dissolved oxygen concentration shall not be reduced below 7.0 mg/l in the Sacramento River…and in all Delta waters west of the Antioch Bridge; 6.0 mg/l in the San Joaquin River…; and 5.0 mg/l in all other Delta waters except for those bodies of water which are constructed for special purposes…"
Floating Material	"Waters shall not contain floating material…in concentrations that cause nuisance or adversely affect beneficial uses."
Turbidity	"Water shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses."

[a] The document indicates that the term "pesticide" refers to herbicides as well as pesticides.

[b] There are multiple aspects to this standard, covering impacts to domestic and municipal water supplies as well as aquatic life. These impacts are discussed in other sections of this chapter. The aspect of the pesticide standard introduced here is used to assess impact to sediments.

3.1.1.2.1 Toxicity

Reward

Reward use could adversely affect general water quality since it involves input of a toxic substance (diquat) into the water column. It would likely be viewed as a violation of the Basin Plan standard regarding input of toxic substances to the water column (see "Toxicity" in Exhibit 3-3) and thus is considered an adverse impact. For a more thorough understanding of the significance of this impact, the toxicity and persistence of Reward are briefly assessed below.

Characterization of Reward Toxicity

Diquat, the active ingredient in Reward, is a moderately toxic compound in EPA toxicity class II. The maximum contaminant level goal[1] (i.e. the MCLG) for diquat, is 0.02 ppm. The target water column concentration of Reward under the EDCP is 0.37 ppm, which is 18.5 times this MCLG. When applied at this concentration, Reward would be toxic to *Egeria* and other aquatic, wetland and terrestrial plants. Further, Reward may have moderate toxicity to aquatic invertebrates. (For a detailed discussion of the toxicity of Reward to biological resources and humans, see Sections 3.2 and 3.5, respectively).

Further, as indicated on the Material Safety Data Sheet for Reward (Appendix J), this herbicide contains a chemical known to cause cancer. Since this chemical is an inert ingredient, (and thus information on it is classified), no information on its identity or concentration is available.

Persistence of Reward in the Water Column

Reward's persistence in the water column is relatively short, ranging from hours to a few days, depending on environmental conditions. The density of the plant mass being treated and the amount of particulate material (organic matter, sediments) in the water column largely determine persistence of this herbicide. Following application, Reward is rapidly absorbed into the leaves of plants, killing all cells it contacts. Thus, treatment of dense weed beds, such as formed by *Egeria*, significantly reduces the amount of time that Reward is present in the water column. Further, the herbicide rapidly binds with particulate material in the water column (Zeneca 1998) and becomes immobile. (Zeneca, 1998, asserts that the soil adsorption values for diquat are an order of magnitude greater than required for a chemical to be classified as immobile.) Thus, persistence of Reward in highly turbid systems is relatively short.

1 The maximum contaminant level goal is the concentration of a drinking water contaminant below which there is no known or expected risk to health. Although it refers to drinking water standards, it is used here to provide a perspective on the toxicity of Diquat.

The immobilized chemical is not "biologically available" and thus not toxic to aquatic plants or organisms. Degradation of the immobilized chemical on plants, in the water column or in the sediments occurs through the activity of microorganisms and by sunlight (i.e. photodegradation).

Most assessments of diquat persistence have focused on lentic (i.e. standing water) systems, such as ponds or lakes. In such systems, an instantaneous concentration of 0.37 ppm can fall to approximately 0.10 ppm after 24 hours and 0.01 ppm after 4 days (Zeneca 1998). Field trials have shown that dissipation and dilution of diquat/Reward in flowing, tidally influenced and highly turbid waters such as the Delta are much more rapid (Richman and Lee 1988). Richman and Lee (1988) established one-acre test plots at three locations in the Delta to examine the persistence of Reward under different environmental and tidal conditions. Test plots were established at White Slough, Owl Harbor and Sand Mound Slough. Persistence differed between these sites, with Owl Harbor exhibiting the longest persistence, followed by Sand Mound Slough, and finally White Slough.

There were also differences between individual applications. Under favorable conditions at Owl Harbor and Sand Mound Slough, concentrations of diquat at the center of the test plot remained at 30 to 75 percent of initial levels after three hours, and continued to be significant even after six hours. On several occasions at these locations, the herbicide sank, actually enhancing the diquat concentration in the hypolimnion after six hours. Faster water movement, as occurs at White Slough, resulted in rapid dissipation of the herbicide within one hour of application. Overall, in four out of five applications, an instantaneous concentration of 0.50 ppm decreased to 0.01 ppm within 12 to 24 hours. These results indicate that the persistence of diquat in a tidal environment is shorter than that observed for closed ponds.

In conclusion, at the concentrations proposed for use under the EDCP, Reward would be toxic to aquatic plants and moderately toxic to aquatic invertebrates. However, the herbicide would dissipate relatively rapidly, due to the turbidity and tidal movement in the Delta. Thus, the toxicological effects of Reward at any given treatment location would be short lived. Therefore, Reward use would result in a temporary unavoidable significant impact to general water quality, due to its toxicity.

Sonar

Sonar use could adversely affect general water quality due to the fact that it involves input of a toxic substance (fluridone) into the water column. It would likely be viewed as a violation of the Basin Plan objective regarding

input of toxic substances to the water column (see "Toxicity" in Exhibit 3-3) and thus is considered an adverse impact. For a more thorough understanding of the significance of this impact, the toxicity and persistence of Sonar are briefly assessed below.

Characterization of Sonar Toxicity

The toxicity of Sonar is low relative to that of other aquatic herbicides. Sonar was given USEPA's lowest herbicide toxicity rating, which is indicated by the signal word displayed on the herbicide label. The maximum contaminant level goal (MCLG) for fluridone is 0.15 ppm, which is 7.5 to 15 times higher than the target concentration for fluridone under the EDCP (0.01 to 0.02 ppm). When applied at this target concentration over an extended period of time, Sonar would be toxic to *Egeria* and other non-target aquatic plants. However, Sonar is not expected to be toxic to fish, aquatic invertebrates or terrestrial organisms. (For a detailed discussion of the toxicity of Sonar to biological resources and to humans, see Sections 3.2 and 3.5, respectively.)

Persistence of Sonar in the Water Column

Sonar tends to dissipate fairly rapidly from the water column following application. Studies indicate that photodegradation is the primary degradation mechanism for fluridone, the active ingredient in Sonar, in aquatic ecosystems (Saunders and Mosier, 1983 and Muir and Grift, 1982). West and Parka (1981) reported that photodegradation occurs rapidly and is not influenced by the type of dispersal mechanism used to introduce Sonar.

The dissipation of Sonar at three locations in the Delta was found to be extremely rapid in field studies conducted by Anderson and others (1998). Anderson and others (1998) measured dissipation and movement of Sonar within and outside of treatment areas following application of Sonar at Big Break Marina, Franks Tract, Venice Island. Sonar applications were made twice per week for six weeks, with the aim of maintaining a water column concentration of 10 to 20 ppb (0.01 to 0.02 ppm). Sampling intervals were weekly, for four to five weeks depending on the site. Of the three sites treated, only Big Break Marina was able to maintained target concentrations of 10 to 20 ppb fairly consistently over the sampling period, although concentrations decreased to less than 10 ppb between days 7 and 14. Due to high flow conditions and/or tidal influences at the other two sites, dissipation of Sonar was rapid: concentrations between 1 and 10 ppb (at Franks Tract) and between 1 and 4 ppb (at Venice Island) were measured.

In conclusion, at the concentration proposed for use under the EDCP, Sonar would be toxic to aquatic plants, but not other aquatic organisms. Further, the concentration of Reward would dissipate relatively rapidly in the Delta. Thus, the toxicological effects of Reward at any given treatment location would be short lived. Therefore, use of Sonar would result in a temporary unavoidable significant impact to general water quality, due to its toxicity.

Mechanical Harvesting

No Impact.

3.1.1.2.1 Dissolved Oxygen

Reward

Reward applications could indirectly lower dissolved oxygen concentration at treatment sites to levels that violate of Basin Plan standards. (Dissolved oxygen standards range from 5.0 to 7.0 mg/l, depending on the location in the Delta. See "Dissolved Oxygen" in Exhibit 3-3.)

Since Reward acts rapidly, following treatment, a relatively large quantity of *Egeria* could begin to decay simultaneously. Decomposition of dead *Egeria* could result in temporary decreases in dissolved oxygen concentrations due to microbial respiration (i.e., consumption of oxygen by the microorganisms responsible for the breakdown of organic material). Thus, treatment of large beds of *Egeria* by Reward could result in localized decreases in dissolved oxygen concentrations.

The magnitude of any decrease in dissolved oxygen depends upon site conditions and dissolved oxygen concentrations prior to treatment. Sites with lower ambient dissolved oxygen concentrations and with limited flow and tidal exchange are most likely to be affected by dissolved oxygen reductions following Reward applications. However, this impact can be avoided through appropriate mitigation measures. In conclusion, use of Reward could result in an avoidable significant impact to general water quality, due to the effect of the herbicide on dissolved oxygen.

Sonar

Sonar applications are unlikely to result in decreases in dissolved oxygen or any violation of Basin Plan standards regarding dissolved oxygen.

Sonar is a slow acting systemic herbicide. It requires an extended period of contact (30 to 60 days) with target plants for the herbicidal effect to be induced (McLaren/Hart Environmental Engineering Corp., 1995). This results in a gradual addition of dead plant material into the water column.

Various researchers (Parka and others 1978, Struve and others 1991) reported that Sonar applications of up to 0.125 ppm have not resulted in significant decreases in dissolved oxygen concentration. In field tests conducted by Arnold (1979), fluridone in an aqueous solution at application rates of up to 1.0 ppm did not change dissolved oxygen concentrations or other water quality parameters (i.e. pH, Biological Oxygen Demand, color, dissolved solids, hardness, nitrate, specific conductance, total phosphates or turbidity). It should be noted that these application rates (0.125 ppm and 1.0 ppm) are much higher than that which would be used under the EDCP. Since these more concentrated treatments did not result in decreases in dissolved oxygen, it is highly unlikely that Sonar treatments under the EDCP would result in such decreases. In conclusion, use of Sonar would not adversely impact dissolved oxygen. This would be a less than significant impact to general water quality.

Mechanical Harvesting

No Impact.

3.1.1.2.3 Sediments

Reward

Reward is not likely to persist in the sediments in any way that would adversely impact beneficial uses, such as water quality, fish or other aquatic organisms. Thus, its use would not likely result in a violation of the Basin Plan objective regarding pesticide residues in the sediments (see "Pesticides" in Exhibit 3-3).

Reward is rapidly absorbed into plant cells or absorbed onto particulate matter. Once bound to particulate matter, Reward is immobile. Thus, although Reward residues may settle out into the sediments, absorbed to particulate matter, these residues are not "biologically available," and thus not toxic to aquatic life. This lack of biological availability is demonstrated by the fact that sensitive rooted plants repeatedly recolonize areas treated with Reward (Zeneca 1998). Reward residues in the sediment rapidly degrade due to microbial processes. (Photodegradation may also occur, but is less likely in the light-limited benthic environment.) In conclusion, use of Reward would not adversely impact Delta sediments. This would be a less than significant impact to general water quality.

Sonar

Like Reward, Sonar is unlikely to persist in the sediments in any way that would adversely impact beneficial uses, such as water quality, fish or other aquatic organisms. Thus, its use would not likely result in a violation of the Basin Plan objectives regarding pesticides residues in the sediments (see "Pesticides" in Exhibit 3-3).

Fluridone, the active ingredient in Sonar, has been found to adhere to sediment particles and organic material within the sediment. Once there, fluridone will gradually desorb from the hydrosoil into the water column, where it will photodegrade (Elanco 1981). USEPA (1986) notes that the half-life of fluridone in the hydrosoil is 90 days. No studies were found that indicated that fluridone adversely affected benthic organisms while in the sediments, or during the photodegradation process. This information suggests that Sonar residues in the sediments would not adversely impact beneficial uses. In conclusion, use of Sonar would not adversely impact Delta sediments. This would be a less than significant impact to general water quality.

Mechanical Harvesting

No Impact.

3.1.1.2.4 Turbidity

Reward

No Impact.

Sonar

No Impact.

Mechanical Harvesting

Mechanical harvesting could result in a temporary increase in turbidity and a violation of Basin Plan standards regulating turbidity, due to harvester maneuvering (see "Turbidity" in Exhibit 3-3). Although the turbidity increase would be temporary, it could adversely impact beneficial uses or cause a nuisance in the Delta for a short period of time. In conclusion, mechanical harvesting could result in a temporary unavoidable significant impact to general water quality due to a increase in turbidity.

3.1.1.2.5 Floating Material

Reward

No Impact.

Sonar

No Impact.

Mechanical Harvesting

Mechanical harvesting could result in a significant impact to general water quality and a violation of the Basin Plan standard regulating floating material in the water column, if a substantial quantity of *Egeria* plant fragments remained uncollected following harvesting operations (see "Floating Material" in Exhibit 3-3).

In a study of production and viability of harvested *Egeria* fragments, Anderson (1998) suggested the number of uncollected *Egeria* fragments following harvesting operations was perhaps ten times that collected. A total of 3,000 fragments were collected per hour during this study, resulting in an estimated total fragment generation of 30,000 per hour. Thus, a substantial quantity of floating *Egeria* fragments likely will be released into the water column following mechanical harvesting. These *Egeria* fragments could cause a nuisance or affect beneficial uses of the Delta. In conclusion, mechanical harvesting could result in an avoidable significant impact to general water quality due to production of plant fragments.

3.1.2 Drinking Water

Adverse impacts to drinking water quality could potentially occur if herbicides or mechanical harvesting were used in the vicinity of any water treatment plant intakes for local or regional drinking water utilities. The Contra Costa Water District (District) diverts water for drinking water use at three Delta intakes: Rock Slough, Old River south of Highway 4 Crossing, and Mallard Slough. All three of the District's intake locations are close to or in the waterways identified as areas of *Egeria* infestation. The possibility exists that the EDCP could degrade the quality of the District's drinking water supply. For example, drinking water could be adversely impacted if herbicide-treated water were diverted into the District's drinking water supplies. This could result in adverse impacts to health (discussed further under Section 3.5.2.1.2).

Additionally, use of these herbicides in the vicinity of water treatment plant intakes could increase the potential for trihalomethane formation in drinking water supplies. Trihalomethanes are suspected carcinogens that can form during the water treatment process. Herbicide treatments that occur in the vicinity of water treatment plant intakes can facilitate the production of trihalomethanes, by providing a source of dissolved organic compounds (i.e. decaying plant material). When these dissolved organic compounds, (also referred to as "trihalomethane precursors") react with the chlorine that is used for disinfection during the water treatment process, trihalomethanes are produced. National Primary Drinking Water Regulations include standards (MCLs) for trihalomethanes.

Finally, mechanical harvesting conducted in the vicinity of water treatment plant intakes could adversely impact drinking water quality due to the temporary increase in turbidity.

3.1.2.1 Drinking Water Significance Threshold

Criteria used to assess impacts to drinking water quality are the National Primary and Secondary Drinking Water Regulations, established by the U.S. Environmental Protection Agency (USEPA) and enforced by the California Department of Health Services (DHS). The DHS is designated by the USEPA as the primary agency in California to administer and enforce requirements of the federal Safe Drinking Water Act (SWDA).

The SDWA, established in 1974, requires the USEPA to regulate contaminants that present health risks and are known or are likely to occur in public drinking water supplies (USEPA, 1999). USEPA fulfills this requirement by establishing and overseeing a set of drinking water standards referred to collectively as the National Primary and Secondary Drinking Water Regulations.

For each contaminant requiring federal regulation, the USEPA has set a non-enforceable health goal referred to as a "maximum contaminant level goal" (MCLG). The MCLG is the level of a drinking water contaminant below which there is no known or expected risk to health.

The USEPA also is required to establish an enforceable drinking water standard as close to the MCLG as is technologically feasible, taking cost into consideration. This enforceable standard is the "maximum contaminant level" (MCL). An MCL is the maximum permissible contaminant level in water delivered to any user of a public water system. Violation of an MCL indicates a potential immediate or long-term health risk.

MCLs form the basis of both the National Primary and Secondary Drinking Water Regulations as described below:

- Primary Drinking Water Regulations - MCLs are established for a number of chemical and radioactive contaminants, and are found in Title 22 California Code of Regulations (CCR). They include inorganic chemicals (64431), trihalomethanes (64439), radioactivity (64441 and 64443), organic chemicals (64444), and lead and copper (64670).
- Secondary Drinking Water Regulations - MCLs are established for a number of chemicals or characteristics. They are set for taste, odor, or drinking water appearance and are found in Title 22 CCR, 64449.

3.1.2.2 Environmental Impacts/Consequences of the EDCP to Drinking Water Quality

This section is organized into the following subsections:

3.1.2.2.1 Unwanted Chemical Constituents

3.1.2.2.2 Potential for Trihalomethane Formation

3.1.2.2.3 Turbidity.

3.1.2.2.1 Unwanted Chemical Constituents

Reward

Reward use would increase the concentration of diquat in the water column above the established MCL. The MCL for diquat is 0.02 ppm. Drinking water supplies containing concentrations of diquat above this 0.02 ppm threshold are considered to present a health risk (USEPA, 1999). The target water column concentration of Reward under the EDCP is 0.37 ppm, or 18.5 times higher than this MCL. Thus, if water treated with Reward were diverted for drinking use, drinking water quality could be adversely impacted.

In conclusion, Reward use could result in an avoidable significant impact to drinking water quality, due to the input of diquat to the water column.

Sonar

Sonar use would not increase the concentration of fluridone in the water column above the established MCL. The target concentration proposed for Sonar under the EDCP is 0.01 ppm to 0.02 ppm. The MCL for fluridone is 0.15 ppm. The target EDCP concentration for Sonar is 7 to 15 times lower than the MCL, and thus would have no adverse effect on drinking water quality. (However, standard treatment protocol would include measures to avoid influx of any herbicides into drinking water supplies.)

In conclusion, use of Sonar at the concentrations proposed under the EDCP would not adversely impact drinking water quality. This would be a less than significant impact to drinking water quality.

Mechanical Harvesting

No Impact.

3.1.2.2.2 Potential for Trihalomethane Formation

Reward

Reward use could increase the potential for trihalomethane (THM) formation when used in the vicinity of water treatment plant intakes. The National Primary Drinking Water standard for THMs is 0.1 ppm. The extent to which herbicide treatments would increase the potential for THM formation is unknown. However, it can be assumed that Reward treatments occurring near water treatment intakes could increase the potential for THM formation. In conclusion, Reward use could result in an avoidable impact to drinking water quality by increasing the potential for THM formation.

Sonar

Like Reward, Sonar use could increase the potential for trihalomethane (THM) formation when used in the vicinity of water treatment plant intakes. In conclusion, Sonar use could result in an avoidable impact to drinking water quality by increasing the potential for THM formation.

Mechanical Harvesting

No Impact.

3.1.2.2.3 Turbidity

Reward

No Impact.

Sonar

No Impact.

Mechanical Harvesting

Mechanical harvesting near water treatment plant intakes could adversely affect drinking water quality by temporarily increasing turbidity in source water diverted for drinking use. The National Secondary Drinking Water standard for turbidity is 5 Turbidity Units. The extent to which turbidity would be increased due to harvester maneuvering is unknown. The turbidity increase would be temporary and would subside once harvester operations ceased. In conclusion, mechanical harvesting could result in avoidable impacts to drinking water quality, due to this temporary increase in turbidity.

3.1.3 Significance Determination for Drinking Water Quality

The EDCP would result in the following unavoidable, avoidable, and less than significant impacts to water quality.

3.1.3.1 General Water Quality

Unavoidable Significant Impacts

- Unavoidable impact due to the toxicity of Reward and Sonar. Approximately 1,600 acres would be directly affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.
- Unavoidable impact due to a temporary increase in turbidity during mechanical harvesting. Approximately 50 acres would be affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.

Avoidable Significant Impacts

- Avoidable significant impact due to the potential for decreases in dissolved oxygen following use of Reward. Approximately 1,300 acres would be affected each year by this impact, if mitigation measures were not implemented.
- Avoidable significant impact due to the production of plant fragments in the water column. Approximately 50 acres would be affected each year by this impact if mitigation measures were not implemented.

Less Than Significant Impacts

- Less than significant impact to sediments due to use of Reward and Sonar.

3.1.3.2 Drinking Water Quality

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- Avoidable significant impact due to the potential influx of diquat and fluridone into water treatment plant intake pipes. Acreage affected depends on location of intake pipes. Mitigation measures are proposed to avoid this impact.
- Avoidable significant impact due to the potential for an increase in trihalomethane formation. Acreage affected depends on location of intake pipes. Mitigation measures are proposed to avoid this impact.
- Avoidable significant impact due to the increase in turbidity during mechanical harvesting.

Less Than Significant Impacts

- None.

3.1.4 Mitigation Measures for General Water Quality

3.1.4.1 General Water Quality

Measures to Avoid and Minimize Decreases in Dissolved Oxygen

- DO Measurements - Prior to any herbicide treatment, the DBW would measure dissolved oxygen throughout the water column. If dissolved oxygen concentrations in the hypolimnion were less than 5 ppm, the DBW would postpone treatment until levels are above this limit.
- Maximum Treatment Acreage - The DBW would treat no more than 20 acres at a given treatment site per day. During late summer and early fall (when dissolved oxygen in the hypolimnion is typically lowest), the DBW would treat no more than 20 acres at a given site over a 14-day period. These avoidance and minimization measures would reduce impacts to dissolved oxygen to a less than significant level and avoid violations of the Basin Plan standard for dissolved oxygen concentration.

Measures to Avoid and Minimize Production of Fragments During Mechanical Harvesting

- Fragment Collection - To maximize fragment collection, the DBW or contractor would follow the mechanical harvester with a fragment collection vessel. The DBW also would not conduct mechanical harvesting on extremely windy days. These minimization measures would insure fragment collection is efficient and effective and reduce the nuisance to a less than significant level. Further, these measures would avoid violations of the Basin Plan objective regulating floating material in the water column.

3.1.4.2 Drinking Water Quality

Measures to Avoid and Minimize Significant Impacts to Drinking Water Quality

- Agency Contact - The DBW would contact appropriate drinking water utilities, as well as the Department of Health Services Drinking Water Program, to inform them that treatment is to occur. This would occur at least two weeks prior to commencement of treatment.

- Buffer Zones - To avoid drinking water quality impacts (e.g., influx of diquat and fluridone, increase in trihalomethane formation potential, increase in turbidity), a one-mile buffer zone would be established around water treatment plant intakes. No treatments or mechanical harvesting operations would occur within this buffer zone without approval by the water agency. The DBW would coordinate with the appropriate public water agencies to establish buffer zones.
- Pre- and Post-Treatment Sampling - As required, the DBW would conduct pre- and post-treatment sampling, including measurements of dissolved oxygen, herbicide residue concentration, biochemical oxygen demand (BOD), total organic carbon (TOC), dissolved organic carbon (DOC), and UVA-254. This sampling effort would be carefully coordinated with the appropriate public water agencies. Data would be shared with interested agencies. If any of these measurements exceeded Primary or Secondary Drinking Water Standards (or any other standard applicable to water diverted for drinking supplies) prior to a scheduled treatment, the treatments would be postponed until conditions were such that drinking water quality would not be compromised by EDCP activities. If post-treatment sampling indicated violations of any standards, changes to the EDCP treatment protocol would be made to avoid future impacts.

3.2 Biological Resources

This section assesses potential impacts to biological resources resulting from the EDCP. The discussion focuses on the effects of the EDCP on abundance, distribution, and health of the aquatic and terrestrial plants and animals that reside or migrate through the Delta. Effects of project activities on threatened, endangered, and other special status species are discussed. Further, effects of EDCP activities to habitat are examined.

This section is organized as follows:

- 3.2.2 Plants
  - 3.2.2.1 Native aquatic plants and algae
  - 3.2.2.2 Intertidal wetland plant communities
  - 3.2.2.3 Terrestrial plants
- 3.2.3 Invertebrates
  - 3.2.3.1 Aquatic invertebrates
  - 3.2.3.2 Insects
- 3.2.4 Fish
  - 3.2.4.1-.3 Direct impacts to fish
  - 3.2.4.4-.5 Indirect impacts to fish
- 3.2.5 Wildlife
  - 3.2.5.1 Reptiles and amphibians
  - 3.2.5.2 Birds
  - 3.2.5.3 Mammals

Potential impacts of EDCP components (Reward, Sonar or Mechanical Harvesting) are assessed. Results from the scientific field trials, as well as findings from primary and secondary scientific literature are presented and discussed.

Baseline information on biological resources in the Delta is presented in Section 2.2 of Chapter 2. Section 2.2 includes life histories of threatened, endangered, and special status species in the Delta that could be present in the project area (i.e., channels, sloughs, channel banks and uplands adjacent to channels of the Delta).

Exhibit R-1 in **Appendix R** lists all special status species found in the Delta and Suisun Marsh, and indicates which species could be impacted by the EDCP. It is assumed that species would not be impacted by the EDCP if they do not 1) occur in the Delta, or 2) occur in or utilize (nest, stage, migrate

through, spawn, breed, forage) habitats potentially impacted by the EDCP (Delta channels, sloughs, channel banks, and upland areas immediately adjacent to channel banks.)

3.2.1 Biological Resources Significance Threshold

Impacts to plants, invertebrates, fish, and wildlife populations are significant when project operations cause or contribute to substantial short or long-term reductions in abundance and distribution. A biological effect is significant based on CEQA Guidelines if it:

- Substantially affects a rare or endangered species of animal or plant or the habitat of the species;
- Interferes substantially with the movement of any resident or migratory fish or wildlife species;
- Substantially degrades water quality (thus adversely affecting species dependent on the water source); or
- Substantially diminishes habitat for fish, wildlife or plants.

Populations of plants, invertebrates, fish, and wildlife species may be reduced because of increases in mortality and changes in habitat availability that affect species survival, growth, migration, and reproduction.

3.2.2 Plants

3.2.2.1 Native Aquatic Plants and Algae

In the Delta, the vigorous growth of *Egeria* has resulted in nearly monospecific beds of this invasive species. Grimaldo and Hymanson (1999) found *Egeria* to be the dominant submergent vegetation type in shallow water areas of the central Delta. The relative abundance of native aquatic plants in *Egeria* beds typically is low, due to the competitive dominance of this species. For this reason, a relatively small percentage of native aquatic vegetation would be subject to herbicide or mechanical harvesting treatments. However, although EDCP operations would target *Egeria*, native aquatic plants and algal species that grow in beds of *Egeria* would be affected to some extent.

Table 3-1 lists common native aquatic plants that occur in the Delta. No special status aquatic plants occur in the Delta.

Table 3-1

Scientific Name	Common Name
Ceratophyllum demersum	Hornwort
Ranunculus aquatilus	Aquatic buttercup
Potamageton nodosus	Long-leaved pondweed
Potamageton pectinatus	Fennel-leaved pondweed
Ruppia cirrhosa	Ditch-grass
Lemna sp.	Duckweed
Azolla filiculoides	Mosquito fern
Ludwigia peploides ssp. *Peploides*	Water primrose

To minimize adverse impacts to native aquatic plants, the DBW selected EDCP sites where aerial photography indicated that estimated *Egeria* abundance was at least 85 percent. To minimize future losses to native vegetation, the DBW would not treat a site where the percent of total vegetation is less than 65 percent *Egeria*.

Egeria abundance at proposed treatment or trial sites could change over the course of the program. If future aerial photography indicates EDCP sites have less than 65 percent of *Egeria*, the DBW would consult with appropriate regulatory agencies to determine whether changes to the EDCP should occur.

The extent of impacts to native aquatic plants and algae from the EDCP depends upon herbicide selectivity and efficacy, as well as the efficacy of mechanical harvesting.

Reward

Reward is a non-selective herbicide and thus could kill plants other than *Egeria*. Successful applications could result in annual semi-permanent removal of *Egeria* from treatment sites. Further, Reward could cause short-term decreases in algal abundance.

However, the 1,300 acres proposed for Reward treatments represents only 2.6 percent of the 50,000 total water body surface acres of the Delta. Thus, only a small percentage of the native aquatic plants in the Delta would be affected by treatment with Reward. Further, expected Reward efficacy in the

Delta is 50 percent. Thus, 50 percent of the original vegetation (which may or may not include native vegetation) would remain at treatment sites. Finally, native plant abundance in the Delta likely would increase as removal of dense beds of *Egeria* opened available substrate for growth.

With respect to algae, abundance is expected to rebound rapidly due to redistribution of algal cells by water flow. In conclusion, the impact of Reward on native aquatic vegetation and algae would be less than significant.

Sonar

Like Reward, Sonar could kill aquatic plants other than *Egeria*. Sonar efficacy in slow-moving waters is estimated at 70 percent. Since Sonar acts systemically, future regrowth of native aquatic plants affected by Sonar is unlikely. Sonar is not an algacide, and thus would not decrease algal abundance.

However, the DBW proposes to treat only 307 acres annually with Sonar, just 0.6 percent of the 50,000 total water body surface acres of the Delta. Thus, only a small percentage of native aquatic plants in the Delta would be affected by treatment with Sonar. Further, with 70 percent efficacy, 30 percent of the original vegetation (which may or may not include native vegetation) would remain at treatment sites. Finally, native plant abundance in the Delta likely would increase with removal of *Egeria*. In conclusion, the impact of Sonar on native aquatic vegetation would be less than significant.

Mechanical Harvesting

Impacts to native aquatic plants and algae from mechanical harvesting would be less than significant for two reasons. First, only a small amount of acreage would be treated using this control method. Secondly, regrowth of plant material following mechanical harvesting is rapid. Mechanical harvesting would not impact algal abundance significantly.

A total of 50 acres would be mechanically harvested annually, less than one percent of the total water body surface acreage of the Delta. Mechanical harvesting is intended for emergency use, to gain immediate control of an area.

Research indicates that regrowth of aquatic plants following mechanical harvesting can be rapid. Researchers assessed the growth rate of *Egeria* following harvesting in a shallow lake in Louisiana (average depth 1.8 meters). They found that regrowth from the rooted plant began immediately after cutting in May, and continued through the end of sampling in September (Johnson and Bagwell, 1979). These researchers also reported that vegetation cut in May was again near the water surface in late August of the same year.

Other native plants may or may not respond this rapidly following mechanical harvesting. In conclusion, the impact of mechanical harvesting to native aquatic vegetation would be less than significant.

3.2.2.2 Intertidal Wetland Plant Communities

Impacts of the EDCP to wetland habitat are considered significant under CEQA. The EDCP could potentially result in impacts to intertidal wetland plant communities that occur along Delta channels and on in-channel islands. These communities are loosely divided into the following three categories: 1) herbaceous intertidal, including special status plants such as Mason's lilaeopsis (*Lilaeopsis masonii*), Delta mudwort (*Limosella subulata Ives.*), rose mallow (*Hibiscus lasiocarpus*), Delta tule pea (*Lathyrus jepsonii Greene ssp. Jepsonii*), as well as rushes and sedges; 2) riparian, including the sensitive Northern California black walnut (*Juglans californicus dimorphus*), as well as willows and cottonwoods; and 3) marsh, including tules and cattails.

These intertidal wetland plant communities could be adversely impacted by wave-wash or flooding during high tide if herbicide concentrations in the channel water are at treatment levels. Loss of sensitive plant species in these communities would constitute a significant impact, and could result in additional adverse effects, such as increases in erosion and corresponding decreases in water quality. Loss of intertidal wetland vegetation could also impact sensitive wildlife species that may use these environments for nesting, cover and forage. (This impact will be discussed below under Section 3.2.5, Wildlife). Additional impacts could occur to these sensitive plant communities due to mechanical harvesting. Neither the extent of acreage potentially impacted nor the intensity of the impact is known.

The potential effects of each of the EDCP treatment methods on intertidal wetland plants are discussed below.

Reward

Reward applications in areas near intertidal wetland plant communities could result in loss of plants or local plant populations. Since Reward is a contact herbicide, impacts could occur due to wave wash or inundation during high tide. Treatments could result in all impacts discussed above under Section 3.2.2.2. However, since Reward is a contact herbicide, there is a greater likelihood that existing populations would not be permanently lost. In conclusion, use of Reward would result in unavoidable significant impacts to intertidal wetland plants, including special status species.

Sonar

Sonar applications in areas near intertidal wetland plant communities could result in loss of plants or local plant populations. Since Sonar is a systemic herbicide, long-term exposure to the herbicide could permanently eliminate existing local populations of intertidal wetland plants near treatment sites. Treatments could result in all impacts discussed above under Section 3.2.2.2.

With Sonar, water column concentrations would be sustained at treatment levels for approximately six weeks. Sonar impacts could result from wave wash, but would be more likely to occur from inundation of wetland areas by Sonar-treated waters during high tide. In conclusion, use of Sonar would result in unavoidable significant impacts to intertidal wetland plants, including special status species.

Mechanical Harvesting

Impacts to intertidal wetland plant communities from mechanical harvesting may occur primarily in two ways. First, impacts may occur due to staging or maneuvering of mechanical harvesting equipment in areas where sensitive plant species are present. Such equipment may include the conveyor system, which transfers plant fragments from the collection barge to a truck on shore. Placement of the conveyor system along channel banks could destroy individual plants or local populations of Mason's lilaeopsis, delta mudwort, rose mallow, delta tule pea and Suisun Marsh aster.

Secondly, *Egeria* fragments escaping collection following mechanical harvesting could cover sensitive plants along the waters' edge, such as Mason's lilaeopsis and delta mudwort. These tiny plants are extremely vulnerable, and local populations are easily decimated by such disturbances. Mechanical harvesting may release a substantial quantity (up to 30,000 per hour) of *Egeria* fragments into the water column (Anderson 1998). In conclusion, mechanical harvesting would result in avoidable significant impacts to intertidal wetland plants, including special status species.

3.2.2.3 Terrestrial Plants

The EDCP would not impact upland terrestrial plant species because herbicide treatments would occur in the water column, and no staging of mechanical harvesting would occur in upland areas.

3.2.3 Invertebrates

3.2.3.1 Aquatic Invertebrates

The EDCP could temporarily decrease aquatic invertebrate abundance in and around treatment sites. Invertebrates could be killed by herbicides or physically removed and destroyed by mechanical harvesting. Loss of invertebrates, such as zooplankton, could also indirectly impact fish that prey upon these organisms. (This impact will be discussed in more detail under Section 3.2.4.)

However, though decreases in invertebrate abundance could occur, they would likely be temporary. Planktonic (floating) invertebrates, such as zooplankton and shrimp, would be reintroduced to treatment areas inadvertently through water flow. Further, benthic (bottom dwelling) organisms and plant-dwelling organisms would likely recolonize treatment areas rapidly once regrowth of plant material began.

No special status aquatic invertebrates occur in the Delta. The remainder of this section describes invertebrate community composition in beds of *Egeria*, and assesses potential impacts to the species present.

Aquatic Invertebrates Commonly Found in Beds of Egeria

Obrebski and others (1998) studied community composition of invertebrates found in *Egeria* beds at several locations in the Delta: Venice Island, Franks Tract, Big Break, Seven Mile Slough and Sandmound Slough. **Exhibit 3-4**, on the following page, lists the aquatic invertebrates found in association with *Egeria* during this study.

None of the species or taxonomic groups identified in the samples are identified as special status species. Obrebski and others (1998) assert that the community composition observed is characteristic of freshwater attached macrophytes in the continental United States. The five most common taxa were:

- Dipteran larvae
- the amphipod *Hyalella azteca*,
- Cladocera
- the snails *Physa sp.*, and *Gyraulus sp.*
- the oligochaete *Stylaria*.

Several of these invertebrates, in particular crustaceans including copepods and dipterans, are consumed by special status fish species such splittail, juvenile chinook salmon, and delta smelt (Moyle 1976, Wang 1986, and Herbold 1987).

EXHIBIT 3-4

Aquatic Invertebrates

Phylum	Class	Order	Family	Genus
Coelenterata				*Hydra*
Platyhelminthes				*Dugesia*
Nemertea				*Prostoma*
Bryozoa				*Plumatella*
Mollusca			Physidae	*Physa*
			Planorbidae	*Gyraulus*
			Ancylidae	*Ferrisia*
Annelida	Oligochaeta		Naididae	*Stylaria*
				Chaetogaster
			Tubificidae	*Tubifex*
			Hirundinea	*Helobdella stagnalis*
				Helobdella fusca
Arthropoda	Crustacea	Amphipoda		*Hyalella azteca*
				Corophium
		Ostracoda		
		Copepoda		
		Cladocera		
			Moinidae	
				Moinodaphnia
			Sididae	
				Sida
			Chydoridae	
				Eurycercus
				Psuedochydorus
Insecta		Odonata	Zygoptera	
		Tricoptera		
		Diptera		
			Culicoidea	
Arachnida		Hydracarina		

Reward

Reward use could result in a decrease in the abundance of aquatic invertebrates in and around treatment sites. Under the EDCP, Reward would be applied to achieve a water column concentration of 0.37 ppm diquat for three to six hours. This concentration could be lethal to certain aquatic invertebrates.

Research indicates that diquat is moderately toxic to aquatic invertebrates (NYSDEC 1981). USEPA (1995) reports a 96-hour LC_{50}[2] of 0.42 ppm for mysid shrimp. Wilson and Bond (1969) found the amphipod *Hyalella azteca* one of the most sensitive aquatic organisms tested, with a 96-hour LC_{50} of 0.048 ppm. These LC_{50} values are close to (in the case of the mysid shrimp) or lower than (in the case of the amphipod) the concentrations at which Reward would be applied. This suggests that at least some aquatic invertebrates could be adversely impacted by Reward use.

Efficacy of Reward is expected to be approximately 50 percent, due to the high levels of turbidity in the Delta. Thus, approximately 50 percent of the original *Egeria* vegetation at any given Reward treatment site is expected to remain following treatment. This remaining vegetation likely would facilitate recolonization of plant-dwelling invertebrates since it would be available as habitat. Invertebrates would be reintroduced to treatment areas inadvertently by water flow. Despite these mediating factors, the impact of Reward on aquatic invertebrates would be significant and unavoidable.

Sonar

Sonar use would not result in a decrease in invertebrate abundance in or around EDCP treatment sites. Under the proposed project, Sonar would be applied to achieve a water column concentration of 10 to 20 ppb (0.01 to 0.02 ppm). This concentration is well below that which is lethal to aquatic invertebrates.

Research indicates that Sonar is toxic to aquatic invertebrates only at high concentrations. The following summarizes relevant research findings. **Table 3-2**, on the following page, summarizes the response of various aquatic invertebrates to fluridone.

- Trumbo (1998) conducted toxicity tests with Sonar and determined the 96-hour LC_{50} value for crayfish (*Procambarus clarkii*) and snails (*Physa sp.*) to be 105.9 mg/l and 130.8 mg/l (as fluridone) respectively.
- USEPA (1986) asserts that the 48-hour LC_{50} value for exposure to fluridone is 6.3 ppm.

2 Lethal Concentration 50, or LC_{50}, is the concentration of toxicant necessary to kill 50 percent of the organisms being tested. It is usually expressed in parts per million (ppm). Length of the test (in hours) is also typically indicated.

- Parka and others (1978) noted that 0.3 ppm of fluridone in water did not significantly reduce total numbers of benthic organisms. However, at the exaggerated rate of 1.0 ppm of fluridone in the water, the total number of benthic organisms were significantly reduced when compared to a control population.
- Naqvi and Hawkins (1989) reported Sonar LC_{50} values of 12.0 ppm, 8.0 ppm, 13.0 ppm and 13.0 ppm for the microcrustaceans *Diaptomus* sp., *Eucyclops* sp., *Alonella* sp., and *Cypria* sp., respectively.
- Hamlink and others (1986) found that for invertebrates, an average 48-hour or 96-hour LC_{50} or EC_{50} (depending on the organism) was 4.3 +/- 3.7 ppm. The representative invertebrates used in the study included amphipods, midges, daphids, crayfish, blue crabs, eastern oysters, and pink shrimp.
- In chronic toxicity tests conducted by Hamelink and others (1986), no effects were observed in daphnids, amphipods, and midge larvae at fluridone concentrations of 0.2, 0.6, and 0.6 ppm, respectively.

These findings indicate that EDCP Sonar treatments would not result in lethal or sublethal effects to invertebrates present at treatment sites. In conclusion, this would be a less than significant impact.

Table 3-2

Response of Various Invertebrates to Fluridone

Organism	LC50 Value (ppm)	Comments	Reference
Procambarus clarkii (crayfish)	105.9	96-hour test	Trumbo 1998
Physa sp. (snail)	130.8	96-hour test	Trumbo 1998
Diaptomus sp. (microcrustacean)	12.0	Not indicated	Naqvi and Hawkins 1989
Eucyclops sp. (")	8.0	Not indicated	Naqvi and Hawkins 1989
Alonella sp. (")	13.0	Not indicated	Naqvi and Hawkins 1989
Cypria sp. (")	13.0	Not indicated	Naqvi and Hawkins 1989
"Representative invertebrates"[a]	4.3+/-3.7	96-hour test	Hamlink and others 1986

[a] "Representative invertebrates" used in the study included amphipods, midges, daphnids, crayfish, blue crabs, eastern oysters, and pink shrimp.

Mechanical Harvesting

Mechanical harvesting likely would result in removal of aquatic invertebrates with harvested plant material. Mechanical harvesting removed and dislodged 11 to 22 percent of all plant dwelling invertebrates during two field trials at a lake in Wisconsin (Engle 1990).

However, it should be noted that mechanical harvesters generally only cut the top five feet of plant material, leaving one to three feet of vegetation still standing. It is likely that a substantial number of plant dwelling and benthic invertebrates would remain in the uncut vegetation. Planktonic invertebrates would be reintroduced to treatment areas inadvertently through water flow. Despite these mediating factors, the impact of mechanical harvesting on aquatic invertebrates would be significant and unavoidable.

3.2.3.2 Insects

The EDCP could adversely affect elderberry, which are protected as habitat for the Federally threatened valley elderberry longhorn beetle. Valley elderberry longhorn beetles are strictly tied to their host plant, and are thus adversely impacted by harm to elderberry.

No other special status insect species occur in the project area.

Impacts to non-listed species are expected to be less than significant. Herbicide applications may kill some insect larvae that occur in the water. However, insect loss would be less than significant, since the total acreage affected by EDCP herbicide treatments is minimal compared to the area in which insect larvae can develop in the Delta.

Reward

Reward use could adversely affect valley elderberry longhorn beetle, by impacting elderberry that grow on channel banks. Elderberry could suffer damage if herbicide-treated water inundated areas where elderberry were present. In conclusion, Reward use could result in avoidable significant impacts to valley elderberry longhorn beetle.

Sonar

Sonar use could adversely affect valley elderberry longhorn beetle, by impacting elderberry that grow on channel banks. Elderberry could suffer damage if herbicide-treated water inundated areas where elderberry were present. In conclusion, Sonar use could result in avoidable significant impacts to valley elderberry longhorn beetle.

Mechanical Harvesting

No impact.

3.2.4 Fish

Use of Egeria Beds by Fish

Shallow vegetated areas function as nurseries for small fish, providing relatively abundant food and shelter from predators. Some native fish of the Delta, including the threatened splittail and delta smelt, are known to use aquatic vegetation for spawning and rearing (McGowan 1998). Likewise, juvenile salmon may use shallow water during their migrations through the Delta.

However, use of dense aquatic vegetation, such as *Egeria*, by fish is not well documented. Although some studies report that dense beds of *Egeria* provide habitat for certain fish, other studies suggest that depressed oxygen levels and reduced temperatures characteristic of beds are limiting to certain species (Cook and Urmi-Konig 1984).

Researchers at San Francisco State University, under contract with the DBW, studied the use of *Egeria* beds by delta smelt, splittail, migratory salmonids, and other fish of the Sacramento-San Joaquin Estuary (McGowan 1998, and McGowan and March 1998). Pop nets and light traps were used to collect fish in *Egeria* beds. Additionally, piles of *Egeria* mechanically harvested during other DBW experiments were sampled and sorted in their entirety for fish and invertebrates. (See McGowan 1998 for an explanation of sampling methods.) Samples were collected from May through late October at six sites in the Delta: Sandmound Slough, Seven Mile Slough, White Slough, Big Break Marina, Frank's Tract, and Little Venice Island. A total of 257 pop-net samples and 193 light trap samples were collected over the sampling period. In the pop-net samples, 2,181 individual fish were collected; 840 fish were collected in the light traps, and 671 fish, crabs, and tadpoles were sorted from the harvested *Egeria*.

A total of fourteen (14) species of fish were collected from the sampling effort as shown in **Table 3-3**, on the following page. Of the fourteen species of fish collected, only one is a native species (prickly sculpin). According to McGowan (1998), species collected were typical non-native residents of the Delta. Small individuals of bluegill, sunfish, largemouth bass, threadfin shad, and inland silversides dominated the catches. No sensitive species such as delta smelt, splittail, juvenile chinook, or steelhead were collected. These data should provide a fairly accurate indication of which fish species may

be found in *Egeria* beds during EDCP operations, since the sampling was conducted during many of the same months that project operations would occur.

McGowan's findings are similar to those of the Grimaldo and Hymanson (1999), who report that introduced fish species and Chinese mitten crabs were most abundant in *Egeria* stands in the Delta, as opposed to other submerged macrophyte habitat types. Further, these researchers found that native fish were far less frequent inhabitants of the *Egeria* beds. The findings of McGowan (1998) and Grimaldo and Hymanson (1999) suggest that *Egeria* is not typically used by native fish species or specifically any threatened, endangered, or special status species as habitat or as a migration corridor.

Table 3-3

Fish Collected in *Egeria* beds within the Delta
(McGowan, 1998)

Species	Big Break	Frank's Tract	Little Venice	Seven Mile Slough	Sandmound Slough	White Slough
Blue gill	X	X	X	X	X	X
Redear			X	X	X	X
Largemouth bass	X	X	X	X	X	X
Black crappie				X	X	X
Warmouth				X	X	X
Golden shiner					X	
Red shiner	X			X		
Cyprinidae					X	
Inland silverside	X	X	X	X	X	X
Killifish	X	X		X	X	
Mosquito fish	X		X		X	X
Threadfin shad	X		X	X	X	X
Brown bullhead					X	
Prickly sculpin	X			X		

Potential for Exposure of Special Status and Other Fish to EDCP Treatments

The potential exists for impacts to occur to native and listed fish species under the EDCP, since these fish do occur in the general project area, whether or not they occur in *Egeria* beds specifically. This section briefly discusses the potential for exposure of special status and other fish to EDCP treatments.

The DBW proposes to conduct EDCP treatments between March and November. Thus, treatments would occur during the critical spawning and rearing period for many fish species, approximately December through June. Larval fish, which are present in the Delta during these months, tend to be much more sensitive to toxins and water quality conditions than are juvenile and adult fish. Not only are larval fish physiologically more sensitive, but they also do not have the same capacity to escape from disturbances as do juvenile and adult fish. **Table 3-4** below identifies when various fish, including special status species, spawn in the Delta.

Table 3-4

Spawning Periods for Various Fish in the Delta

Fish Species	Spawning in Delta	Reference
Delta smelt	December-July	Wetland Goals 1997
Splittail	January-July	Wetland Goals 1997
Longfin smelt	December-June	Wang 1986
Striped bass	Peak: May-June	Wetland Goals 1997
Prickly sculpin	January-May	Wang 1986

The EDCP treatment period also coincides temporarily with the migration and emigration of certain runs of chinook salmon through the Delta. **Table 3-5** below lists the timing of salmon migration and emigration through the Delta.

Table 3-5

Timing of Adult Migration and Juvenile Emigration of Chinook Salmon Through the Delta
(Entrix 1996)

Fish Species/Run	Adult Migration	Emigration
Winter-run chinook	December to June	July to October of following year
Spring-run	March to September	October through April
Late fall-run	October to April	November to January
Fall-run	July to December	April to June

Fish could be directly and indirectly impacted by EDCP activities. Direct impacts could occur through herbicide toxicity, bioaccumulation of herbicides, and physical destruction from mechanical harvesting. Indirect impacts include impacts to habitat and to the invertebrate prey base. These impacts are discussed below.

3.2.4.1 Direct Impacts to Fish: Toxicity

Herbicide use under the EDCP could result in loss of fish, including special status species, due to herbicide toxicity. The following discusses the toxicity of Reward and Sonar to various fish species.

Reward

Reward use is unlikely to have direct adverse impacts to fish during or following treatments. Under the EDCP, Reward would be applied to achieve a water column concentration of 0.37 ppm diquat for three to six hours. This concentration is less than the levels identified as lethal to fish.

Results of toxicity tests using diquat are summarized below and presented in **Table 3-6**, on the following page:

- NYSDEC (1981) considers diquat, to have moderate toxicity to fish at certain concentrations, while EXTOXNET (1996) describes it as moderately to practically non-toxic to fish.
- The 8-hour LC_{50} for diquat is 28.5 ppm for Chinook salmon and 12.3 for rainbow trout (Pimentel 1971).
- The 96-hour LC_{50} is 16 ppm for northern pike, 20.4 ppm for fingerling trout, 245 ppm for bluegill, 60 ppm for yellow perch, and 170 ppm for black bullhead (Johnson and Finley 1980, Simonin and Skea 1977).
- Toxicity tests conducted on walleye, largemouth bass and smallmouth bass during early life stages resulted in 96-hour LC_{50} values of 0.74 to 4.9 ppm (Paul and others 1994). These researchers found that diquat is more toxic to fish tested than was fluridone. The tests indicated that the very early life stages of walleye are the most sensitive, and that walleye are in general more sensitive than largemouth bass or smallmouth bass.
- Surber and Pickering (1962) found a 96-hour LC_{50} of diquat to largemouth bass of 7.8 ppm.
- 96-hour LC_{50} values for bluegill have been reported at 35 ppm (Gilderhus 1967), while similar test indicated that 96-hour LC_{50} value for mosquitofish is 289 ppm.
- Although Paul and others (1994) assert that diquat may be lethal to early life stages of certain game fish, the lowest LC_{50} value (0.74 ppm) they identify is still higher than the concentration of diquat 0.37 ppm that would be used under the proposed EDCP.

Table 3-6

Response of Various Fish Species to Diquat Concentration

Species	LC_{50} Value (ppm)	Comments	Reference
Chinook salmon	28.5	8-hour test	Pimentel 1971
Rainbow trout	12.3	8-hour test	Pimentel 1971
Northern pike	16	96-hour test	Johnson and Finley 1980
Fingerling trout	20.4	96-hour test	Johnson and Finley 1980
Bluegill	245	96-hour test	Johnson and Finley 1980
Bluegill	35	96-hour test	Gilderhus 1967
Yellow perch	60	96-hour test	Johnson and Finley 1980
Black bullhead	170	96-hour test	Johnson and Finley 1980
Larval walleye, largemouth bass, smallmouth bass	0.74 to 4.9	96-hour test	Paul and others 1994
Largemouth bass	7.8	96-hour test	Surber and Pickering 1962
Mosquito fish	298	96-hour test	Gilderhus 1967

Reward concentrations would be rapidly diluted in the flowing water system of the Delta, limiting the time that fish are exposed to the herbicide. Additionally, the high turbidity in the Delta would further reduce the time diquat is available in the water column, since diquat binds irreversibly with sediment particles. (See Section 3.1.1.2.1 for a thorough discussion of persistence of Reward in the water column.) Thus the opportunity for exposure of Reward to non-target organisms such as fish is small.

These data indicate that the application rate for diquat proposed under the EDCP would be unlikely to result in a direct loss of adult, juvenile or larval fish. In conclusion, exposure of fish to Reward at EDCP target concentrations would result in less than significant impacts.

Sonar

Sonar use is unlikely to have direct adverse impacts to fish exposed during or following treatments. Under the EDCP, Sonar would be applied to achieve a water column concentration of 10 to 20 ppb (0.01 ppm to 0.02 ppm). This concentration is well below that known to result in lethal effects to fish species.

Research on fluridone impacts to various fish species is summarized below and presented in **Table 3-7** on the following page.

- The USEPA (1986) reports that the LC_{50} for rainbow trout (*Salmo gairdneri*) and bluegill (*Lepomis macrochirus*) exposed to fluridone for a 96-hour period was 11.7 ppm and 12.0 ppm respectively, between 600 and 1,000 times greater than the target water column concentration for the EDCP.
- Results of numerous acute and chronic toxicity tests conducted by Hamelink and others (1986) revealed similar findings. These researchers found 96-hour LC_{50} concentrations of 10.4 + 3.9 ppm for the representative fish used in their study: rainbow trout (*Salmo gairdneri*), fathead minnows (*Pimephales promelas*), channel catfish (*Ictalurus punctatus*), bluegills (Lepomis macrochirus), and sheepshead minnows (*Cyprinodon variegatus*). Channel catfish fry exposed to fluridone concentrations of 0.5 ppm were not significantly affected. Catfish fry growth was reported as reduced at fluridone concentrations of 1.0 ppm. Chronic exposure of fathead minnows to mean concentrations of 0.48 ppm did not produce adverse effects.
- Fluridone concentrations of 0.95 and 1.9 ppm resulted in reduced survival of fathead minnows within 30 days of hatching (Hamelink and others 1986).
- USEPA (1986) also lists a Maxium Acceptable Toxicant Concentration (MATC) of greater than 0.48 ppm, but less than 0.96 ppm, for exposure of fathead minnow fry (*Pimephales promelas*) to fluridone. This indicates that no treatment related effects to fathead minnows were observed at or below 0.48 ppm.

Table 3-7

Response of Various Fish to Varying Concentrations of Fluridone

Species	LC50 Value (ppm)	Comments	Reference
rainbow trout	11.7	96-hour test	USEPA 1986
rainbow trout	10.4 +/- 3.9	96-hour test	Hamelink and others 1986
Bluegill	12.0	96-hour test	USEPA 1986
Bluegill	10.4 +/- 3.9	96-hour test	Hamelink and others 1986
fathead minnow	10.4 +/- 3.9	96-hour test	"
Sheepshead minnow	10.4 +/- 3.9	96-hour test	"
channel catfish	10.4 +/- 3.9	96-hour test	"
channel catfish fry	Not applicable	No effect on fry exposed to 0.5 ppm fluridone	"
channel catfish fry	Not applicable	Reduction in growth of fry exposed to 1.0 ppm	"
fathead minnows	Not applicable	No adverse effects to minnows exposed to 0.48 ppm	"
fathead minnows	Not applicable	Reduced survival of minnows exposed to 0.95 and 1.9 ppm	"

Like Reward, Sonar would be rapidly diluted in the Delta, limiting the period of time that fish are exposed to the herbicide. (See Section 3.1.1.2.1 for a discussion of the persistence of Sonar in the water column.)

These findings indicate that the frequency and concentrations at which Sonar would be applied would not result in a direct loss of adult, juvenile or larval fish. In conclusion, exposure of fish to Sonar at the concentrations proposed for use under the EDCP would result in less than significant impacts.

Mechanical Harvesting

No Impact.

3.2.4.2 Direct Impacts to Fish: Bioaccumulation

Herbicide use under the EDCP could potentially result in bioaccumulation of toxic substances in the food chain. This could impact fish as well as wildlife species that prey upon those fish. Further, as discussed in Section 3.5.2.1.3 (Hazards), if the herbicides proposed for the EDCP bioaccumulate in tissues of fish or invertebrates commonly consumed by human beings, adverse impacts to human health could result.

Bioaccumulation Defined

Bioaccumulation is an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in organisms whenever they are taken up and stored faster than they are broken down (metabolized) or excreted (EXTOXNET 1993).

A number of terms are used in conjunction with bioaccumulation. Bioconcentration is the specific bioaccumulation process by which the concentration of a chemical in an organism becomes higher than its concentration in the air or water around the organism. Although the process is the same for both natural and man-made chemicals, the term bioconcentration usually refers to chemicals foreign to the organism. For fish and other aquatic animals, bioconcentration after uptake through the gills (or sometimes the skin) is usually the most important bioaccumulation process. Biomagnification describes a process that results in the accumulation of a chemical in an organism at higher levels than are found in its food. It occurs when a chemical becomes increasingly concentrated as it moves through a food chain (EXTOXNET 1993).

Bioaccumulation Pathways

Bioaccumulation of chemicals in herbicides can occur in fish tissues due to direct uptake through the gills or skin (EXTOXNET 1993) or by consumption and ingestion of invertebrates or other fish that have bioaccumulated these chemicals. Wildlife can potentially bioaccumulate herbicides either by direct uptake through the skin (in the case of frogs and aquatic snakes), drinking of water treated by an herbicide, or consumption of fish and other organisms that had bioaccumulated the herbicide. The potential for bioaccumulation to occur, as well as the potential impacts due to bioaccumulation, depend on the ingredients of the herbicide, environmental conditions, and the physiology of the organism exposed to the herbicide.

Reward

The U.S. National Library of Medicine (1995) asserts that there is little or no bioconcentration of diquat in fish or other aquatic organisms because of the herbicides very high solubility in water. Likewise, Zeneca (1998) asserts that Reward does not have any potential for bioaccumulation. If ingested, diquat is rapidly excreted by fish and other animals. Consequently, there is no potential for biomagnification through food chains (Zeneca 1998). In conclusion, exposure of fish to Reward would not result in bioaccumulation in the tissues of fish (or other aquatic organisms). This would be a less than significant impact.

Sonar

Studies indicate that fluridone has a low potential for accumulation in fish and other aquatic organisms (USEPA 1986). Several researchers have observed instances of bioaccumulation of fluridone, however, these studies generally involved exposure to much higher concentrations of the chemical than would be used under the EDCP. West and others (1983) identified total average bioconcentration factors for total fluridone residues of 1.33 for edible tissue, 7.38 for inedible tissue, and 6.08 for whole body. These data were obtained from 175 fish samples collected from across the country. Muir and others (1980) reported bioconcentration factors of up to 85 in duckweed following exposure to 5.0 ppm of fluridone in water. West and others (1979) reported bioconcentration factors ranging from 0 to 15.5 in vascular plants following exposure to 0.10 ppm of fluridone in water. These peak values of fluridone residues were followed by a decline in concentrations as fluridone dissipated from the water column.

No circumstance was identified in the scientific literature where fluridone irreversibly accumulated in biological tissues and remained after the dissipation of the chemical from the water column. In conclusion, is unlikely that Sonar use at the concentrations proposed under the EDCP would result in bioaccumulation to any significant degree or in any way that would result in adverse impacts to fish (or other aquatic organisms). This would be a less than significant impact.

Mechanical Harvesting

No Impact.

3.2.4.3 Direct Impacts to Fish: Physical Removal and Destruction of Fish

Reward

No impact.

Sonar

No impact.

Mechanical Harvesting

Mechanical harvesting, could result in removal and physical destruction of fish using stands of aquatic vegetation as habitat, or who migrate through such stands. During mechanical harvesting, fish could be injured or killed by

harvester cutting bars, or more likely, could become entangled in harvested plant material and removed from the water column.

In one study, mechanical harvesting of the submersed aquatic weed hydrilla in a shallow Florida lake resulted in an estimated loss of 32 percent of the total number of fish and 18 percent of fish biomass (Haller and others, 1980). Mechanical harvesting removed one-fourth of all fry in a Wisconsin lake (Engel 1990); these fry were generally 15 to 60 mm long. However, the remaining 75 percent of fry escaped harvesting by darting toward shore or open water when the harvester approached. Whether fish were removed during harvesting depended on their number, size, location inshore, thickness of vegetation, and handling of harvester (Engel 1990).

As noted above, no special status fish species were found in the samples collected by McGowan (1998; see Table 3-3). Only one native fish, prickly sculpin, was found. Thus, it is unlikely that direct impacts to sensitive or native fish species would occur due to mechanical harvesting. However, despite the fact that special status and other fish species are unlikely to occur in *Egeria* beds, the potential exists for mechanical harvesting to result in a direct loss of adult, juvenile or larval fish. In conclusion, this would be an unavoidable significant impact.

3.2.4.4 Indirect Impacts to Fish: Impacts to Habitat

Loss of Acreage of Egeria in Shallow Water Habitat

An indirect impact to fish, including special status species, could occur through alteration of spawning, rearing, and foraging habitat. The definition of harm under the Endangered Species Act (ESA) prevents major acts of habitat destruction and degradation that prevent a species from breeding, feeding, and sheltering (Mueller 1994). Special status fish species could be impacted by removal of large beds of aquatic plants that they use as habitat. As explained, available data does not indicate that any threatened, endangered, or special status fish species use *Egeria* beds for spawning, rearing, or forage. Nor have any migratory fish, such as steelhead or chinook salmon, been observed in *Egeria* beds. However, while there is not evidence that *Egeria* beds function as habitat for these fish, it is possible that in some instances they do serve habitat functions. Thus, their removal could negatively impact sensitive fish species to some extent due to loss of cover, rearing, and forage areas.

However, this potentially adverse impact would likely be more than offset by the benefits derived from opening up substrate for native aquatic plants. Removal of *Egeria* would likely result in improvements to fish habitat, by

enabling native aquatic vegetation to colonize areas previously dominated by *Egeria*. While *Egeria* is generally too dense for spawning, rearing, and foraging by native fish, native aquatic vegetation, which is generally less dense, is ideal for these functions.

Loss of Native Aquatic Plants

Treatment of *Egeria* is likely to remove native aquatic plants growing near treatment sites. Native plants may be utilized frequently by special status fish for rearing, cover and forage. In particular, shallow vegetated habitat is believed to be important to the spawning success of splittail and delta smelt. Loss of cover, rearing, and forage area to special status species could constitute a significant impact if large enough areas of native plants are removed.

While loss of habitat is an important impact to consider, it is unlikely that the EDCP would result in significant loss of native aquatic vegetation. As discussed in Section 3.2.2.1, only sites that exhibit a high percentage of *Egeria* (approximately 85 percent relative abundance) were chosen for treatment. Further, the EDCP would only treat between 1,500 to 1,700 acres of *Egeria* each year. This is a small percentage of the total amount of the shallow water habitat present in the Delta. The area of lost vegetated habitat would be small relative to the area of similar habitat available in the area, thus such habitat loss should have minimal effects on fish populations.

Impacts to Habitat due to Decreases in Dissolved Oxygen

Another potential impact to habitat could occur due to the rapid decay of *Egeria*, other aquatic macrophytes, and algae, following application of certain herbicides. Decomposition of this vegetative material may create an organic carbon slug, which could in turn reduce dissolved oxygen concentrations. Low dissolved oxygen can result in fish kills and impede migration of salmonids.

Reward

Reward use could potentially result in decreases in dissolved oxygen. As a contact herbicide, Reward is taken up quickly and produces results rapidly (McLaren/Hart Environmental Engineering Corp. 1995). The sudden addition of decaying plant biomass in the water column could potentially result in a rapid decrease in dissolved oxygen, if no minimization measures were incorporated into project operations. Resulting impacts include fish kills and blockage of salmonid migration. In conclusion, use of Reward could result in avoidable significant impacts to the habitat of special status and other fish species due to the potential for decreases in dissolved oxygen. As discussed

under Section 3.2.2.1, loss of native vegetation due to Reward use would be a less than significant impact to fish habitat.

Sonar

Decreases in dissolved oxygen due to rapid decomposition of plant material are not expected to occur following the use of Sonar. Sonar is a slow-acting systemic herbicide that can take 30 to 60 days to produce its herbicidal effect on the target population (McLaren/Hart Environmental Engineering Corp., 1995). Thus, addition of organic material into the water column would be slow. McLaren/Hart Environmental Corp. (1995) cite various researchers (Parka and others 1978, Struve and others 1991) who reported that Sonar applications of up to 0.125 ppm have not resulted in significant decreases in dissolved oxygen content. In field tests conducted by Arnold (1979), fluridone in an aqueous solution at application rates of up to 1.0 ppm did not change water quality parameters as measured by dissolved oxygen, pH, biochemical oxygen demand (BOD), color, dissolved solids, hardness, nitrate, specific conductance, total phosphates, and turbidity.

In conclusion, no impacts to fish habitat are expected due to decreases in dissolved oxygen following application of Sonar. However, measures would be followed to assure that dissolved oxygen content is not decreased below acceptable levels. As discussed under Section 3.2.2.1, loss of native vegetation due to use of Sonar would be a less than significant impact to fish habitat.

Mechanical Harvesting

Mechanical harvesting of *Egeria* could potentially result in an indirect impact to sensitive fish species due to loss of habitat. However, this impact is likely temporary and less than significant, as regrowth of *Egeria* can be rapid. Researchers assessing the growth rate of *Egeria* following harvesting in a shallow lake (average depth 1.8 meters) in Louisiana, found that regrowth from the rooted plant began immediately after cutting in May, and continued through the termination of the sampling period in September (Johnson and Bagwell, 1979). These researchers report that vegetation cut in May was again near the water surface in late August of the same year. Other native plants may or may not respond this rapidly following mechanical harvesting.

Thus, elimination of habitat for special status species due to mechanical harvesting would likely constitute a temporary impact, unless repeated harvesting efforts kept plant growth to a minimum. Further, the area of lost habitat would be small relative to the area of similar habitat available in the area. The maximum area that would be mechanically harvested at any one time is 10 acres. Further, the total area subject to mechanical harvesting in a

given year is 50 acres. Such habitat loss should have minimal effects on fish populations. In conclusion, mechanical harvesting would result in less than significant impacts to fish habitat.

3.2.4.5 Indirect Impacts to Fish: Decrease in Abundance of Invertebrate Prey Base

Special status fish species could be impacted indirectly if the EDCP decreased the abundance of invertebrates upon which these fish feed. If mechanical harvesting or application of herbicides resulted in a high mortality to certain invertebrates, fish that feed on those invertebrates could be adversely affected.

Prey Base of Special Status Fish Species

Juvenile chinook salmon feed on various aquatic and terrestrial insects, crustaceans, chironomid larvae and pupae, caddisflies (in fresh water), and *Neomysis* spp., *Gammarus* spp. and *Crangon* spp. in more saline water (Wang 1986). Juvenile delta smelt primarily eat planktonic crustaceans, small insect larvae, and mysid shrimp while older fish feed almost exclusively on copepods (Moyle 1976). Splittail are opportunistic benthic foragers that consume copepods, dipterans, detritus, algae, clams, and amphipods. Herbold (1987) found that splittail select *Neomysis* as their main prey item in the estuary.

Aquatic Invertebrates That Occur in Stands of Egeria

Exhibit 3-4 in Section 3.2.3.1 identifies aquatic invertebrates found in *Egeria*. Several of these invertebrates, in particular various crustaceans including copepods and dipterans, are consumed by special status species such as splittail, juvenile chinook salmon, and delta smelt (Moyle 1976, Wang 1986, and Herbold 1987).

Loss of certain aquatic invertebrates, such as copepods and dipterans, could be potentially significant to delta smelt, given that delta smelt abundance is believed correlated with invertebrate abundance. However, this impact would likely be temporary, since planktonic (floating) invertebrates, such as zooplankton and shrimp, would be reintroduced to treatment areas inadvertently through water flow. Further, benthic (bottom dwelling) organisms and plant-dwelling organisms likely would recolonize a treatment area relatively rapidly once regrowth of plant material began.

Reward

Section 3.2.3.1 discusses the potential impact of Reward on aquatic invertebrate abundance. In conclusion, use of Reward could result in an indirect significant unavoidable impact to special status fish species due to a potential decrease in invertebrate abundance.

Sonar

Section 3.2.3.1 discusses the potential impact of Sonar on aquatic invertebrate abundance. In conclusion, Sonar use would result in a less than significant indirect impact to special status fish species, with respect to Sonar's effect on the invertebrate prey base.

Mechanical Harvesting

Section 3.2.3.1 discusses the potential impact of mechanical harvesting on aquatic invertebrate abundance. In conclusion, mechanical harvesting could result in an indirect significant unavoidable impact to special status fish species due to a potential decrease in invertebrate abundance.

3.2.5 Wildlife

3.2.5.1 Reptiles and Amphibians

Reptiles and amphibians could be adversely affected by exposure to herbicide-treated water, or by impacts to channel bank habitat. Impacts to channel bank habitat include loss of intertidal wetland vegetation due to herbicide use, and disturbance due to staging or maneuvering of mechanical harvesting equipment. No impacts related to bioaccumulation are anticipated, since neither Reward nor Sonar accumulates in the tissues of animals to any significant degree. (See Section 3.2.4.1.2 for a discussion of herbicide bioaccumulation.)

The following special status reptiles and amphibians utilize the sloughs, channels and channel banks in the EDCP project area and could be impacted by project activities: giant garter snake, Northwestern and Southwestern pond turtles, and the California red-legged frog.

Reward

No information is available on the toxicity of Reward or its active ingredient, diquat, to reptiles and amphibians. Absent this information, it must be assumed, since Reward is a toxic substance, that exposure of reptiles and

amphibians to this herbicide could result in loss or sublethal effects to individual animals. Further, as discussed in Section 3.2.2.2, Reward could result in loss of intertidal wetland vegetation, which may serve as habitat for certain reptiles and amphibians. In conclusion, Reward use could result in unavoidable significant impacts to reptiles and amphibians, including the special status species mentioned above, due to its toxicity and effect on channel bank habitat.

Sonar

No laboratory toxicity tests have been conducted on reptile or amphibian species using Sonar or its active ingredient, fluridone (McLaren/Hart Environmental Engineering Corp. 1995). However, Arnold (1979) observed that frogs (*Rana* spp.), watersnakes (*Nerodia* spp.) and softshell turtles (*Trionyx* spp.) exposed in field trials to an aqueous solution of fluridone at application rates of up to 1.0 ppm were not obviously impacted by the herbicidal application. This concentration is 50 to 100 times higher than the target concentration for fluridone under the EDCP. These observations suggest that exposure of amphibians and reptiles to fluridone would not likely result in adverse impacts to reptiles or amphibians.

However, as discussed in Section 3.2.2.2, Sonar could result in loss of wetland intertidal vegetation, which may serve as habitat for certain reptiles and amphibians. In conclusion, Sonar use could result in unavoidable significant impacts to reptiles and amphibians, including special status species, due to its effect on channel bank habitat.

Mechanical Harvesting

Reptiles and amphibians that occupy channel banks adjacent to treatment areas could be impacted by staging or maneuverings of mechanical harvesting equipment. Placement of such equipment along channel banks could result in disturbance, harm, or loss of individual animals. In conclusion, mechanical harvesting would result in avoidable significant impacts to reptiles and amphibians, including special status species, due to habitat impacts.

It is assumed that reptiles and amphibians would be able to escape areas in the water column where harvesting is occurring, and thus would not be subject to in-channel impacts. This would be a less than significant impact.

3.2.5.2 Birds

Birds could be adversely affected by exposure to herbicide-treated water or indirectly by impacts to channel bank habitat where nesting may occur. Impacts to habitat include loss of intertidal wetland vegetation due to herbicide use, and disturbance, due to staging or maneuvering of mechanical harvesting equipment. No impacts related to bioaccumulation of herbicides would occur, since neither Reward nor Sonar accumulates in animal tissues to any significant degree. (See Section 3.2.4.1.2 for a discussion of the potential for herbicide bioaccumulation.)

Waterfowl could be inadvertently impacted if "managed wetlands" (i.e., flooded agricultural fields) in the Delta were inadvertently flooded with herbicide-treated water. Many agricultural fields are flooded in the winter to provide foraging and roosting sites for migratory waterfowl. However, since no EDCP operations would occur during winter flood-up, no impacts of this type would occur.

In the recent past, much concern has been directed toward the impact of channel and channel bank activities on Swainson's hawks (State listed threatened), which occasionally nest in trees along channel banks in the Delta. The Swainson's hawk nesting season is March 15 through September 1, which coincides with EDCP project activities. However, no adverse impacts are expected to occur to this species for two reasons. First, treatment in any given area would be temporary (1-2 days), thus any disturbance would be short-lived. Second, Swainson's hawks can tolerate a relatively high degree of human activity adjacent to their nests (Bradbury, pers. com.). Thus, nesting birds are unlikely to be disturbed by project-related activities.

The following special status bird species utilize the sloughs, channels and channel banks in the EDCP project area and could be impacted by project activities: California black rail, greater sandhill crane, short-eared owl, tricolored blackbird and white-faced ibis.

Reward

No information is available on the toxicity of Reward or its active ingredient, diquat, to birds. Absent this information, it must be assumed, since Reward is a toxic substance, that exposure of birds to this herbicide (through ingestion of water or external contact) could result in loss or sublethal effects to individual birds. Further, as discussed in Section 3.2.2.2, Reward could result in loss of intertidal wetland vegetation, which may serve as habitat for certain birds, including special status species such as California black rail, greater

sandhill crane and tricolored blackbird. In conclusion, Reward use could result in unavoidable significant impacts to birds, including special status species, due to its toxicity and effect on channel bank habitat.

Sonar

Exposure to Sonar-treated water is not expected to result in loss or sublethal effects to birds. In studies with mallards, maximum concentrations of 5,000 ppm in the diet of young birds caused no mortality (McLaren/Hart Environmental Engineering Corp. 1995). Continuous administration of technical fluridone at concentrations up to 1,000 ppm in the diet for six months caused no effects to juveniles or adults, or to reproduction, egg shell thickness, hatchability, and survival of the young. At the concentrations used in these studies, which are considerably higher than EDCP target concentrations, Sonar was not toxic to birds.

However, as discussed in Section 3.2.2.2, Sonar could result in loss of intertidal wetland vegetation, which may serve as habitat for certain birds, including special status species. In conclusion, Sonar use could result in unavoidable significant impacts to birds, including special status species, due to habitat impacts.

Mechanical Harvesting

Birds that nest along channel banks could be impacted by staging or maneuverings of mechanical harvesting equipment. Placement of such equipment along channel banks could result in disturbance, harm, or death to individual birds. In conclusion, mechanical harvesting would result in avoidable significant impacts to birds, including special status species, due to habitat impacts.

3.2.5.3 Mammals

Exposure of mammals to EDCP activities is expected to be minimal. Mammals could be affected by changes in channel bank habitat following herbicide treatments, or due to staging or maneuvering of mechanical harvesting equipment. However, no special status mammals live along Delta channel banks, thus this impact would be less than significant. No impacts related to bioaccumulation are expected to occur, since neither Reward nor Sonar accumulates in the tissues of animals to any significant degree. (See Section 3.2.4.1.2 for a discussion of the herbicide bioaccumulation.)

The following special status species utilize the sloughs, channels and channel banks in the EDCP project area: Small-footed myotis bat and Yuma myotis bat. Since these bats forage for insects over water, they could potentially be impacted indirectly by EDCP activities if herbicide treatments reduced insect abundance. However, as discussed in Section 3.2.3.2, the EDCP would not significantly reduce insect abundance in the Delta. Impacts to these special status species would be less than significant.

Reward

As explained above, the EDCP, including Reward use, would result in less than significant impacts to mammals.

Sonar

As explained above, the EDCP, including Sonar use, would result in less than significant impacts to mammals.

Mechanical Harvesting

As explained above, the EDCP, including mechanical harvesting, would result in less than significant impacts to mammals.

3.2.6 Significance Determination for Biological Resources

3.2.6.1 Plants

Unavoidable Significant Impacts

- Unavoidable significant impact to intertidal wetland plants, including special status species, due to inundation with Reward and Sonar. Approximately 1,600 acres would be directly affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.

Avoidable Significant Impacts

- Avoidable significant impact to intertidal wetland plants, including special status species, due to staging of mechanical harvesting equipment. Approximately 50 acres would be affected each year by this impact, if proposed mitigation measures were not implemented.
- Avoidable significant impact to intertidal wetland plants, including special status species as a result of *Egeria* fragments covering plants following mechanical harvesting. Approximately 50 acres would be affected each year by this impact, if proposed mitigation measures were not implemented.

Less Than Significant Impacts

- Less than significant impact to native aquatic plants from the EDCP.
- Less than significant impact to terrestrial plants from the EDCP.

3.2.6.2 Invertebrates

Unavoidable Significant Impacts

- Unavoidable significant impact to aquatic invertebrates due to use of Reward and mechanical harvesting. Approximately 1,375 acres would be affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.

Avoidable Significant Impacts

- Avoidable significant impact to the valley elderberry longhorn beetle habitat (i.e. elderberry shrubs), due to use of Reward and Sonar. Acreage affected depends on the number and location of trees. Measures are available to mitigate for this impact.

Less Than Significant Impacts

- Less than significant impact to aquatic invertebrates, due to use of Sonar.
- Less than significant impacts to insects other than special status species, from the EDCP.

3.2.6.3 Fish

Unavoidable Significant Impacts

- Unavoidable significant impact to fish due to removal and/or physical destruction of individual fish, including special status species, by mechanical harvesting. Approximately 50 acres would be affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.
- Unavoidable significant impact to fish due to decreases in prey (aquatic invertebrate) abundance following use of Reward and mechanical harvesting. Approximately 1,350 acres would be affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.

Avoidable Significant Impacts

- Avoidable significant impact to critical habitat, due to the potential for decreases in dissolved oxygen, following Reward use. Approximately 1,375 acres would be affected each year by this impact, if proposed mitigation measures were not implemented.

Less Than Significant Impacts

- Less than significant impact to fish from exposure to Reward and Sonar.
- Less than significant impact to fish with respect to bioaccumulation of Reward and Sonar.
- Less than significant impact to fish habitat from Sonar and mechanical harvesting.

3.2.6.4 Wildlife

Unavoidable Significant Impacts

- Unavoidable significant impact to reptiles and amphibians, including special status species, due to use of Reward and Sonar. Approximately 1,600 acres would be affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.
- Unavoidable significant impacts to birds, including special status species, due to use of Reward and Sonar. Approximately 1,600 acres would be affected each year by this impact. Mitigation measures are proposed to minimize this impact to the extent possible.

Avoidable Significant Impacts

- Avoidable significant impact to reptiles and amphibians, including special status species, due to mechanical harvesting. Approximately 50 acres would be directly affected each year by this impact, if proposed mitigation measures were not implemented.
- Avoidable significant impact to birds, including special status species, due to mechanical harvesting. Approximately 50 acres would be directly affected each year by this impact, if proposed mitigation measures were not implemented.

Less Than Significant Impacts

- Less than significant impact to mammals, including special status species, from the EDCP.

3.2.7 Mitigation Measures for Impacts to Biological Resources

In addition to the mitigation measures described below, all field personnel would be trained in sensitive species awareness and impact avoidance prior to beginning field work.

3.2.7.1 Plants

Mitigation Measures for Impacts to Intertidal Wetland Plants

- Prior to any herbicide application, a qualified botanist would survey channel banks adjacent to treatment sites to determine whether sensitive plant species are present. If the site exhibits a high percentage of intertidal wetland communities and associated sensitive plants, the site may not be treated. To the degree possible, herbicide application would occur during low tide to decrease the likelihood that sensitive plants would be inundated. Herbicide application would be focused in the mid-channel region to decrease the possibility that concentrated herbicides would come in contact with sensitive plants growing along the channel bank. Following treatment, channel banks would again be surveyed to determine whether loss of sensitive intertidal wetland plants occurred. If substantial loss is evident, changes may be made in the treatment protocol to decrease the possibility that impacts may occur in the future.
- Prior to mechanical harvesting, channel banks adjacent to treatment sites would be surveyed by a qualified botanist to determine the presence of sensitive plant species. The area around special status plants would be flagged and no staging or movement of harvester equipment would be allowed within the flagged area.
- *Egeria* fragments would be collected by harvesters in such a way as to ensure that fragments do not pile up along channel banks.

3.2.7.2 Invertebrates

Mitigation Measures for Impacts to Aquatic Invertebrates

- Mechanical harvesting sites would not be larger than 10 acres in size. Harvesters would not cut vegetation more than five feet below water level, thus leaving one to three feet of standing vegetation. This would minimize the loss of plant-dwelling invertebrates and facilitate recolonization by invertebrates. Mechanical harvesting would be timed to allow for recolonization of harvested areas before adjacent sites are treated.

- No more than 20 acres would be treated with Reward on any given day in a given treatment site. For sites larger than 20 acres, upstream portions would be treated first and the downstream treatment would be treated at least at least 14 days later. These measures would decrease the overall loss of invertebrates and would minimize impediments to recolonization.

Mitigation Measures for Impacts to Special Status Insects

- Pre-treatment botanical surveys would include flagging of any elderberry shrubs that may be inundated during high tide. Herbicide treatments would not occur along channels where elderberry shrubs could be adversely impacted.

3.2.7.3 Fish

Mitigation Measures for Impacts to Fish Habitat

- Prior to any herbicide treatment, dissolved oxygen would be measured throughout the water column. If concentrations in the hypolimnion were less than 5 ppm, treatment would be postponed until levels increase above this limit. The DBW would treat no more than 20 acres per day at a given treatment site. During late summer and fall (when DO in the hypolimnion is typically lowest), no more than 20 acres would be treated at a given treatment site over a 14-day period.

Mitigation Measures for Impact to Fish Prey Base

- See "Mitigation Measures for Impacts to Aquatic Invertebrates," above.

Mitigation Measures for Impacts to Fish Due to Mechanical Harvesting

- In order to avoid impacts to sensitive fish species due to mechanical harvesting, the following avoidance measures would be used. First, all requirements identified by the regulatory agencies, such as USFWS, NMFS and CDFG would be adhered to. These could involve, for example, suspending harvesting operations for specific periods of time to avoid disrupting fish migration or spawning, or avoiding certain habitat conditions. Prior to mechanical harvesting, Interagency Ecological Program (IEP) Real Time Monitoring data would be obtained and evaluated (if available and relevant to the treatment site) to determine whether any sensitive fish species had been identified in the treatment area. Further, if required by regulatory agencies, a pre-treatment fish survey following the

protocol for pop-net use established by McGowan (1998) would be conducted by a qualified biologist to further assess the presence of threatened, endangered or sensitive fish species in the vicinity of the project site. This monitoring would be conducted 1 to 2 days prior to the commencement of treatment. If the number of specieal status fish identified through the IEP data or the pop-net surveys were above a certain threshold level, treatment would be postponed until additional surveys indicated that fewer sensitive fish were present in the area. The threshold number would be determined through consultation with the appropriate regulatory agencies.

- For the first two years of the EDCP, a representative sample of the harvested material would be examined by a qualified biologist to assess any incidental taking of any special status species. This information would be reported to the appropriate regulatory agencies and adjustments to program protocol could be made in order to minimize impacts.

3.2.7.4 Wildlife

Mitigation Measures for Impacts to Wildlife due to Mechanical Harvesting

- Prior to mechanical harvesting, channel banks and uplands adjacent to treatment sites would be surveyed by a qualified wildlife biologist to assess whether special status reptile, amphibian, or bird species may be present. Areas which show evidence of the presence of such species (e.g. nests, burrows) or which exhibit ideal habitat conditions for a particular sensitive species would be flagged. No staging or mechanical harvesting equipment would be allowed in these specified areas.

Mitigation Measures for Impacts to Birds due to Reward and Sonar

- See "Mitigation Measures for Impacts to Intertidal Wetland Plants," above.

3.3 Agricultural Resources

This section assesses impacts of the EDCP to agricultural resources in the Delta. Baseline information on agricultural resources is contained in Section 2.3 of Chapter 2. Exhibit 3-2 describes impacts to agricultural resources and proposed mitigation measures, and indicates impact significance are pre- and post-mitigation.

CEQA Guidelines (Appendix I, Appendix G) indicate that a project may significantly impact agricultural resources if it:

- Is incompatible with existing land use in the vicinity;
- Affects agricultural resources or operations; or
- Impairs the agricultural productivity of prime agricultural land.

Under the EDCP, agricultural operations may be impacted. This could potentially impair agricultural productivity of the Delta.

3.3.1 Agricultural Resources Significance Threshold

In accordance with CEQA, and for the purposes of this EIR, impacts to agricultural resources are considered significant if they directly or indirectly convert prime agricultural land to nonagricultural use, or impair the agricultural productivity of prime agricultural land.

3.3.2 Environmental Impacts/Consequences to Agriculture

Approximately 1,800 agricultural diversions occur in the Delta (DWR 1993). During the peak summer irrigation season, diversions from these facilities collectively exceed 4,000 cubic feet per second. The EDCP could adversely impact agricultural crops and operations, since treatments would occur during the irrigation season.

EDCP treatments occurring adjacent to agricultural diversions could result in adverse impacts to nearby agricultural crops, since irrigation with herbicide-treated water may injure irrigated vegetation. Both Reward and Sonar could reduce growth or possibly kill crops they contact. Thus, under the EDCP, agricultural productivity of prime agricultural land could be impaired to some extent, if mitigation measures were not incorporated into treatment protocols.

Additionally, irrigation could be disrupted due to excessive fragment generation following mechanical harvesting. This also could impair agricultural productivity unless mitigation were incorporated.

Reward

Label restrictions indicate that Reward can adversely impact agricultural crops. Thus, Zeneca (1998) recommends suspension of irrigation for specific periods of time, depending on crop type, as follows:

- For food crops, irrigation can commence 5 days following application at the maximum allowable application rate.
- For turf and ornamentals, irrigation can commence 3 days following application at maximum allowable application rate.

If followed, these guidelines would avoid adverse impacts. In conclusion, Reward use could result in avoidable significant impacts to agricultural crops.

Sonar

Label restrictions indicate that Sonar can adversely impact agricultural crops. SePRO Corporation (1994) recommends suspension of irrigation for specific periods of time, depending on the crop type, as follows:

- For established tree crops, irrigation can commence 7 days following treatment.
- For established row crops, irrigation can resume 14 days following treatment.
- For newly seeded crops, seedbeds or areas to be planted, irrigation can resume 30 days following treatment (SePRO Corporation 1994).

If followed, these guidelines would avoid adverse impacts. In conclusion, Sonar use could result in avoidable significant impacts to agricultural crops.

Mechanical Harvesting

During mechanical harvesting, *Egeria* fragments may be lost despite efforts to collect all severed plant materials. Studies show that a substantial quantity of *Egeria* fragments may remain uncollected following harvesting (Anderson, 1998). If harvesting were to occur adjacent to agricultural diversions, uncollected *Egeria* fragments could clog intakes, and interfere with irrigation. Additionally, smaller plant fragments might be transported into irrigation ditches through unscreened intakes. In conclusion, mechanical harvesting could result in avoidable significant impacts to agricultural operations.

3.3.3 Significance Determination for Agricultural Resources

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- Avoidable significant impact to agricultural crops, due to Reward and Sonar use. Approximately 1,600 acres would be directly affected each year by this impact, unless mitigation measures were incorporated.
- Avoidable significant impact to agricultural operations due to mechanical harvesting. Approximately 50 acres would be affected each year by this impact if mitigation measures were not implemented.

Less Than Significant Impacts

- None.

3.3.4 Mitigation Measures for Agricultural Resources

Measures to Avoid and Minimize Impact to Agricultural Crops

Prior to beginning herbicide treatments that are to occur near agricultural diversions, the appropriate County Agricultural Commissioner's Office would be contacted. The DBW and the Commissioner's Office could negotiate ideal times for treatments. Local landowners could then be informed of the particular periods of time during which irrigation should not occur.

As a further precaution against impacts to irrigated crops, post-treatment monitoring would include sampling for water quality parameters, including measuring of herbicide concentrations in the water column at regular intervals following treatment. Following treatment, concentrations of Reward would be monitored in the water 48 and 96 hours following treatment. Samples at sites treated with Sonar would be taken seven days following each application of the herbicide. Samples would be processed by a qualified analytical laboratory. Once herbicide levels have decreased to less than harmful concentrations, the DBW would contact the appropriate County Agricultural Commissioner's Office, who could in turn contact nearby landowners.

Measures to Avoid and Minimize Impacts to Agricultural Operations

Prior to mechanical harvesting that is to occur near any agricultural diversion, the appropriate County Agricultural Commissioner's Office would be contacted. The DBW and the Commissioner's Office could negotiate ideal times for treatments. Local landowners would then be informed of the particular periods of time during which irrigation should not occur.

Further, a collection vessel would follow each mechanical harvester. This would increase the effectiveness and efficiency of fragment collection and would reduce the impact to a less than significant level.

If excessive amounts of *Egeria* fragments occur in areas adjacent to agricultural intakes following standard collection efforts, an additional collection effort would be made. Once the number of fragments decreased sufficiently, the appropriate Agricultural Commissioner's Office would be contacted.

3.4 Utilities and Service Systems

This section assesses impacts of the EDCP to utilities and service systems in the Delta. Baseline information on the utilities and service systems of the Delta is presented in Section 2.4 of Chapter 2. Exhibit 3-2 describes impacts to utilities and service systems and proposed mitigation measures, and indicates impact significance pre- and post- mitigation.

CEQA Guidelines (Appendix I, Appendix G) indicate that a project may significantly impact utilities and service system if it would require substantial alterations to the following utilities:

- Power or natural gas
- Communication systems
- Local or regional water treatment or distribution facilities
- Sewer or septic tanks
- Storm water drainage
- Solid waste disposal
- Local or regional water supplies.

The only utility or service systems that could potentially be impacted by the proposed EDCP are local or regional water treatment or distribution facilities. While Section 3.1 discussed contamination of drinking water supplies, this section focuses on the potential impacts to water supply operations.

3.4.1 Utilities and Service Systems Significance Threshold

For the purposes of this analysis, utilities and service systems impacts are considered significant if implementation of a proposed action would directly or indirectly result in a need for new systems or supplies, or substantial alteration to the following utilities: power or natural gas; communications systems; local or regional water treatment or distribution facilities; sewer or septic tanks; storm water drainage; solid waste disposal; or local or regional water supplies.

3.4.2 Environmental Impacts/Consequences to Utilities and Service Systems

The primary utility diverting water for drinking supplies is the Contra Costa Water District (CCWD). CCWD has intake facilities at three locations in the Delta:

- Rock Slough
- Mallard Slough
- Old River south of Highway 4 Crossing.

All three intake facilities are close to or in the waterways identified for *Egeria* control. EDCP treatments could adversely impact water treatment operations by increasing the debris load at intake facilities. This could result in increased costs to treatment facilities.

Reward and Sonar

Municipal water utilities, such as the CCWD, may be adversely affected by herbicide treatments due to increased debris loading at intake facilities. Debris loading could increase dead plant material that has the potential to become dislodged following herbicide treatments and clog intake screens and pumps. Alternatively, debris loading could increase if excessive amounts of *Egeria* fragments remained uncollected following mechanical harvesting. In conclusion, Reward and Sonar use could result in avoidable significant impacts to municipal water operations.

Mechanical Harvesting

Mechanical harvesting could potentially result in an increase in the debris load at water facilities intake pumps or screens due to plant fragmentation. Such debris could clog fish screens at intake facilities, reducing their efficiency and increasing operational costs. In conclusion, mechanical harvesting could result in avoidable significant impacts to municipal water operations.

3.4.3 Significance Determination for Utilities and Service Systems

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- Avoidable significant impact to water utilities, due to increased debris load following use of Reward and Sonar. Acreage affected depends on proximity of treatment to intake facilities. Mitigation is available to avoid this impact.
- Avoidable significant impact to water utilities, due to increased debris load following mechanical harvesting. Acreage affected depends on proximity of treatment to intake facilities. Mitigation is available to avoid this impact.

Less Than Significant Impacts

- None.

3.4.4 Mitigation for Utilities and Service Systems

The DBW would consult with the appropriate drinking water utilities to determine when treatments would occur. Consultation would occur at least two weeks prior to commencement of treatment. Further, a one-mile buffer zone would be established around water treatment plant intakes. No herbicide or mechanical harvesting treatments would occur within this buffer zone while utilities are drawing water and without consultation with the appropriate water agency. The DBW would coordinate with the appropriate public water agencies to establish those buffer zones.

3.5 Hazards and Hazardous Materials

This section focuses on hazards that could potentially occur due to the EDCP. Baseline information on potential hazards in the Delta is presented in Section 2.5 of Chapter 2. Exhibit 3-2 describes impacts and proposed mitigation measures from hazards and indicates impact significance pre- and post-mitigation.

CEQA Guidelines (Appendix I, Appendix G) indicates that a project may pose a significant hazard if it involved:

- A risk of accidental explosion or release of hazardous substances (including, but not limited to: oil, pesticides, chemicals, or radiation);
- Possible interference with an emergency response plan or emergency evacuation plan;
- The creation of any health hazard or potential health hazard;
- Exposure of people to existing sources of potential health hazards; or
- Increased fire hazard in areas with flammable brush, grass, or trees.

The EDCP could potentially expose people and the environment to hazardous substances.

3.5.1 Significance Criteria for Hazards and Hazardous Materials

The criteria used to determine whether identified impacts are significant and adverse were developed using of the CEQA Guidelines. For the purposes of this analysis, an action would have a significant effect if it would create a potential public health hazard or involve the use, production, or disposal or materials which pose a hazard to people in the area affected, or interfere with emergency response plans or emergency evacuation plans.

3.5.2 Environmental Impacts/Consequences

3.5.2.1 Impacts to Human Health

People may be exposed to herbicides proposed for use under the EDCP in the following ways: 1) consumption of drinking water contaminated with herbicides; 2) consumption of fish or other aquatic organisms that have bioaccumulated herbicide residues; 3) swimming or water skiing in areas recently treated with these herbicides; 4) handling of concentrated herbicides during the application process. The discussion below first presents

background information on Reward and Sonar toxicity, then assesses the probability that humans would be exposed to these herbicides in any of the ways mentioned above. Finally, mitigation measures are proposed to minimize the possibility that exposure would occur.

There are no human health hazards associated with mechanical harvesting.

3.5.2.1.1 Toxicity

This discussion touches upon the impact of inert ingredients on herbicide toxicity. The following overview is presented to clarify the treatment of inert ingredients during the herbicide registration process.

Herbicide compounds consist of an active ingredient and various inert ingredients, that is, ingredients that do not exhibit herbicidal activity. These substances perform secondary functions, such as aiding the thickening or dispersal of the active ingredient. Typically, information on inert ingredients is classified, and thus not available for publication. In some instances, toxicological effects can result from both the inert and active ingredients.

Federal law requires that aquatic herbicides undergo a thorough evaluation and registration process before they can be shipped or sold in the United States. To obtain registration, manufacturers are required to conduct numerous studies (i.e. over 120 depending upon the intended uses). Further, they must submit a thorough and extensive data set to USEPA to demonstrate that, under its conditions of use, the product would not pose a significant risk to human health and the environment, and that the herbicide is effective against target weeds or plants. Although these documents are classified, they are considered, under CEQA (Pub. Res. Code. Sec. 21080.5), to be the functional equivalent of a full-scale environmental impact report. As such, these documents must include a discussion of environmental impacts, mitigation measure and alternatives.

All of the herbicides included in the proposed EDCP have been through this review process. Previous discussions of impacts resulting from Reward and Sonar use have covered toxicological effects of the active ingredients, as well as of the entire herbicide formulation. Thus, any impacts due to inert ingredients would have been covered in the discussions of the latter. However, any additional specific information that is available regarding the inert ingredients in Reward and Sonar is included in the toxicity discussion below.

Reward

The following summarizes information on the toxicity of diquat, the active ingredient in Reward:

- Toxicity studies show that diquat is moderately toxic via ingestion, with reported LD_{50}[3] values of 120 mg/kg[4] in rats, 233 mg/kg in mice, 188 mg/kg in rabbits, and 187 mg/kg in guinea pigs and dogs (Kidd and James 1991, Stevens and Sumner, 1991). These concentrations are at least 300 times the EDCP target concentration of diquat. Ingestion of sufficient doses may cause severe irritation of the mouth, throat, esophagus, and stomach, followed by nausea, vomiting, diarrhea, severe dehydration, and alterations in body fluid balances, gastrointestinal discomfort, chest pain, diarrhea, kidney failure, and toxic liver damage (Stevens and Sumner 1991).
- Toxicity studies with animals indicate that diquat did not reduce fertility in experimental animals (Stevens and Sumner 1991). Rats receiving 1.25 mg/kg/day decreased their food intake and showed slowed growth, but had unchanged reproduction. Fertility was reduced in male mice given diquat during different stages of sperm formation. Neither fertility nor reproduction was affected in a three-generation study of rats given dietary doses of 12.5 or 25 mg/kg/day of diquat, although some growth retardation was seen at the 25 mg/kg/day dose. Based on this evidence it is unlikely that diquat would effect reproduction in humans under normal circumstances.
- Diquat does not appear to causes permanent changes in genetic material. For example, no mutagenic effects were seen in mice given oral doses of 10 mg/kg/day for five days (Clayton and Clayton 1981). Studies also indicate that diquat would not cause teratogenic effects in humans under normal circumstances (EXTOXNET 1996).
- Research indicates that diquat is not carcinogenic. (However, Reward does contain a chemical known to cause cancer. See bullet below.) An 80-week feeding study showed that dietary doses of 15 mg/kg/day of diquat did not cause tumors in rats (USEPA 1981). Likewise, dietary levels of 36 mg/kg/day for two years did not induce tumors in rats (Stevens and Sumner 1991). Based on this evidence, it appears that diquat is not carcinogenic.

3 The Lethal Dose 50 or LD_{50} is the amount of a chemical that is lethal to one-half (50 percent) of the experimental animals exposed to it. LD_{50}s are usually expressed as the weight of the chemical per unit of body weight (mg/kg). It may be fed (oral LD_{50}), applied to the skin (dermal LD_{50}), or administered in the form of vapors (inhalation LD_{50}).

4 One milligram per killogram (mg/kg) is equivalent to one part per million (ppm).

- Inert ingredients comprise 63.6 percent of the Reward formulation. The Material Safety Data Sheet for Reward (Zeneca Ag Products 1999) indicates that the product Reward contains a chemical known to cause cancer. The identity of the chemical and the amount present in Reward is not known. No other information on the inert ingredients of this product is available.

Sonar

The following summarizes information on toxicity of fluridone, the active ingredient in Sonar:

- Acute toxicity studies have shown that the LD_{50} values for rats (*Rattus norvegicus*) and mice (*Mus musculus*) exposed orally to fluridone is greater than 10,000 mg/kg (Elanco 1981). Administration of Sonar to rats at 0.5 ml/kg did not provoke a lethal response. The LD_{50} for cats (*Felis domesticus*) exposed orally to fluridone was greater than 250 mg/kg, while for dogs (*Canis familiaris*) it was greater than 500 mg/kg. The concentrations that produced lethal responses in these studies are between 25,000 and 1,000,000 times higher than the EDCP target concentration for fluridone.
- In 90-day subchronic feeding studies, no treatment-related effects were noted in rats at dietary doses of 330 mg/kg or in mice at dietary doses of fluridone of 62 mg/kg. No toxic effects were observed in dogs at dietary doses of fluridone of 200 mg/kg/day. In chronic toxicity studies, dietary levels of fluridone of 200 mg/kg did not produce toxicological or carcinogenic effects for either a one- or two-year test period.
- Studies with experimental animals indicate that Sonar does not impact fertility, or have carcinogenic or teratogenic effects. In 90-day subchronic feeding studies, no treatment-related effects were noted in rats at dietary doses of 330 mg/kg or in mice at dietary doses of fluridone or 62 mg/kg. No toxic effects were observed in dogs at dietary doses of fluridone of 200 mg/kg/day. In chronic toxicity studies, dietary levels of fluridone of 200 mg/kg did not produce toxicological or carcinogenic effects for either a one or two-year test period. In reproductive studies, fluridone was not teratogenic to rats at 200 mg/kg/day or rabbits at 750 mg/kg/day when administered during the organogenesis phase of gestation. Three successive generation of rats maintained on diets containing 2,000 mg/kg of fluridone showed no impairment of fertility, liveborn litter size, gestation length or survival, progeny survival or sex distribution (Elanco 1981).

- Sonar A.S. and Sonar SRP do not contain any inert ingredients listed on the USEPA list of "Inerts of Toxicological Concern" or list of "Potentially Toxic Inerts/High Priority for Testing" (McLaren/Hart Environmental Engineering Corp. 1995). The primary inert ingredient in Sonar A.S. is water, making up approximately 45 percent of the formulation. The second largest (approximately 10 percent) is propylene glycol, a compound used in facial creams and other health and beauty produces (SePRO Corp 1998). Other inert ingredients are added to serve as wetters and dispersants in the formulation and to prevent freezing during storage. Trace amounts of an antifoaming agent and a preservative are also added. The primary inert ingredient in Sonar SRP is clay, which makes up approximately 89 percent of the formulation. Small amounts of a binder are added to maintain the integrity of the pelleted formulation. SePRO Corp. (1998) asserts that there is no reason for concern about the inert ingredients used in Sonar.

3.5.2.1.2 Consumption of Contaminated Drinking Water

Reward

There are health risks associated with consumption of water treated with Reward. The maximum contaminant level goal (concentration at which no adverse risk to health occur) as well as the maximum contaminant goal (enforceable drinking water standard under the National Primary Drinking Water Regulations) for diquat is 0.02 ppm. Under the EDCP, Reward would be used to achieve a water column concentration of 0.37 ppm, which would result in concentrations of diquat that are 18.5 times higher than this standard.

Further, Reward contains a chemical known to cause cancer. Since this chemical is an inert ingredient (and thus information on it is classified), no information on its identity or concentration is available.

Thus, the presence of Reward in drinking water supplies at target concentrations would represent a health risk. Product label information specifies that water treated with Reward should not be used for drinking purposes for three days following application. In conclusion, contamination of drinking water supplies by Reward is an avoidable significant impact, and thus, related impacts to human health are also significant, but avoidable.

Sonar

There are also health risks associated with consumption of water treated with Sonar. However, at EDCP target concentrations, Sonar would not adversely affect public water supplies. The MCL for fluridone in drinking water is

0.15 ppm, while the target concentration for Sonar under the EDCP is 0.01 to 0.02 ppm. This target concentration is lower than the drinking water standard, and thus would have not adversely affect drinking water quality, should contamination of drinking water supplies occur.

In conclusion, contamination of drinking water supplies by Sonar would have a less than significant impact on human health. However, measure would be undertaken to avoid influx of herbicide treated waters to public water supplies.

3.5.2.1.3 Consumption of Fish or Aquatic Organisms Exposed to Herbicides

Reward

Consumption of fish or other aquatic organisms exposed to Reward is not expected to result in adverse impacts to human health. Diquat is highly water soluble, and thus does not accumulate in the tissues of aquatic organisms. In conclusion, impacts to human health due to bioaccumulation of Reward in tissues of fish and aquatic organisms would be less than significant.

Sonar

Consumption of fish or other aquatic organisms exposed to Sonar is not expected to result in adverse impacts to human health. Aquatic organisms can accumulate fluridone in tissues following exposure to high concentrations of the chemical (West and others 1983). However, studies show that fluridone residues in animal tissues declined as fluridone dissipated from the water column. Considering the rapid dilution of fluridone in the water column and the low target concentration for the herbicide, it is unlikely that bioaccumulation would occur to any significant degree.

Further, the USEPA-designated tolerance level for residues of fluridone in fish and crayfish is 0.5 ppm (USEPA 1986), which is significantly higher than the EDCP target concentration of fluridone. If accumulation of the herbicides were to occur in fish tissues, it would still be well below the level associated with adverse impacts to human health. In conclusion, impacts to human health due to bioaccumulation of Sonar in tissues of fish and aquatic organisms would be less than significant.

3.5.2.1.4 Swimming and Water Skiing

Reward

Product label information for Reward indicates that areas treated with the herbicide may be used for swimming or other water recreation immediately following application. No adverse health impacts would result from in-water recreation in areas treated with Reward at EDCP target concentrations. In conclusion, impacts to human health due to swimming or water skiing in water treated with Reward would be less than significant.

Sonar

The product label information for Sonar does not specify any restrictions for swimming or in-water recreation. These activities may be undertaken immediately following Sonar application. In conclusion, impacts to human health due to swimming or water skiing in water treated with Sonar would be less than significant.

3.5.2.1.5 Exposure to Concentrated Herbicides

Reward

Adverse impacts to health could occur to persons applying or handling Reward if they ingested, inhaled or were sprayed by a concentrated formulation of the herbicide. The Reward product label indicates that the herbicide may be fatal if swallowed, inhaled, or absorbed through the skin; that it causes substantial, but temporary eye injury and skin irritation; and that contact with irritated skin, or a cut, or repeated contact with intact skin may result in poisoning. Adherence to herbicide handling procedures would minimize the possibility of such a health risk. In conclusion, exposure to concentrated formulations of Reward could result in avoidable significant impacts to human health.

Sonar

Adverse impacts to health could occur to persons apply or handling Sonar if they ingested or were sprayed by a concentrated formulation of the herbicide. Ingestion of either Sonar A.S. or SRP would be harmful, although oral toxicity for a single dose is low (SePRO 1998a, 1998b). Prolonged exposure to the liquid formulation (Sonar A.S.) may cause slight irritation to skin, while no skin irritation is expected, due to handling of the pelleted formulation. At room temperature, vapors of Sonar A.S. are minimal due to physical properties, and a single exposure is not likely to be hazardous. Sonar SRP (the pelleted

formulation) is not considered an inhalation hazard. Adherence to herbicide handling procedures would minimize the possibility of any health risk occurring. In conclusion, exposure to concentrated formulations of Sonar could result in avoidable significant impacts to human health.

3.5.2.2 Hazards to the Environment due to Catastrophic Herbicide Spill

Reward and Sonar

A catastrophic spill of either Reward or Sonar could result in adverse impacts to aquatic wetland and intertidal habitat and associated flora and fauna, including special status plants, fish and wildlife. Adverse impacts to human health could also occur due to exposure of concentrated herbicides following a catastrophic spill. Impacts could also occur to public water supplies, and agricultural production and operations. The degree of harm would depend on the amount of chemical spilled, environmental conditions (flow, tidal action) and emergency response time. Such a catastrophic spill of herbicides would be an avoidable significant impact.

3.5.3 Significance Determination for Hazards

The EDCP would result in the following unavoidable, avoidable and less than significant, impacts to Human Health.

3.5.3.1 Human Health

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- Avoidable significant impact to human health due to contamination of drinking water supplies with Reward. Acreage affected depends on the location of drinking water intakes. Mitigation measures are available to avoid this impact.
- Avoidable significant impact to human health due to exposure to concentrated formulation of Reward or Sonar. Acreage determination is not applicable. Mitigation measures are available to avoid this impact.

Less Than Significant Impacts

- Less than significant impact to human health, if influx of Sonar entered drinking water supplies. (Despite the fact that this is a less than significant impact, measures would be undertaken to insure that such an influx does not occur.)
- Less than significant impact to human health, with respect to bioaccumulation of Reward and Sonar in tissues of fish and aquatic organisms.
- Less than significant impact to human health, due to swimming or water-skiing in water treated with Reward or Sonar. (Despite the fact that this is a less than significant impact, measures would be undertaken to notify the public regarding treatments. See mitigation measures below.)

3.5.3.2 Hazards to the Environment due to Catastrophic Herbicide Spill

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- Avoidable significant impact to aquatic and intertidal wetland habitat and associated flora and fauna, invertebrates, fish and wildlife; human health; drinking water supplies; and agricultural production and operations, due to potential catastrophic spill of Reward or Sonar. Approximately 1,600 acres would be directly vulnerable to this impact each year. Mitigation measures are available to avoid this impact.

Less than Significant Impacts

- None.

3.5.4 Mitigation for Impacts Related to Hazards

3.5.4.1 Human Health

Measures to Avoid Contamination of Drinking Water Supplies

- *Agency Consultation* - Consultation with the appropriate drinking water utilities, as well as the Department of Health Services, to determine when treatments would occur. Consultation would occur least two weeks prior to commencement of treatment.

- *Buffer Zones* - To avoid drinking water quality impacts (e.g., influx of diquat and fluridone), a one-mile buffer zone would be established around water treatment plant intakes. No treatments would occur within this buffer zone while utilities are drawing water. Treatments within buffer zones would be coordinated with utilities. The DBW would coordinate with the appropriate public water agencies to establish buffer zones.

Minimization and avoidance measures for any herbicide treatments that is to occur within a certain number of miles of a public water intake (distance as yet to be determined) would involve the following:

- Pre- and Post-Treatment Sampling - If required by regulatory agencies or appropriate utilities, the DBW would conduct pre- and post-treatment sampling for biochemical oxygen demand (BOD), total organic carbon (TOC), dissolved organic carbon (DOC), and UVA-254. This sampling would be in addition to standard pre- and post-treatment sampling for DO, herbicide residue, turbidity, etc. These sampling efforts would be carefully coordinated with the appropriate public water agencies. Data would be shared with interested agencies. If any of these measurements exceeded Drinking Water Standards prior to a scheduled treatment, the treatment would be postponed until conditions were such that drinking water quality would not be compromised by EDCP activities. If post-treatment sampling indicated violations of any standards, changes to the EDCP treatment protocol would be made to avoid future impacts.

Measure to Avoid and Minimize Public Exposure to Herbicide-Treated Water

- Prior to treatments, marina and dock owners would be notified regarding timing of treatments. During herbicide treatments, sites would be marked with buoys, making herbicide treatment more visible to the general public. Additionally, DBW staff would patrol treatment areas on a support boat, informing recreators that treatments are occurring.

Measures to Avoid and Minimize Exposure to Concentrated Formulation of Herbicides

- To avoid impacts to human health due to exposure to concentrated formulations of Reward, all personnel involved with the application of EDCP herbicides would be trained in herbicide handling in accordance with the Food and Agriculture Code and Title 3 Code of Regulations Pertaining to Pesticides and Pest Control Operations. Participants would learn about herbicide toxicity, use

of product labels and material safety data sheets (MSDS), proper handling of herbicides, emergency and first aid procedures in case of a spill, and the proper clothing and eye protection.

All aspect of the "Herbicide Handling Procedures and Spill Contingency Plan" would be followed. These documents are contained in **Appendix S**.

3.5.4.2 Hazards to the Environment due to Catastrophic Herbicide Spill

Measures to Avoid and Minimize Exposure to Concentrated Formulation of Herbicides

- To avoid impacts to human health due to exposure to concentrated formulations of Reward, all personnel involved with the application of EDCP herbicides would be trained in herbicide handling in accordance with the Food and Agriculture Code and Title 3 Code of Regulations Pertaining to Pesticides and Pest Control Operations. Participants would learn about herbicide toxicity, use of product labels and material safety data sheets (MSDS), proper handling of herbicides, emergency and first aid procedures in case of a spill, and the proper clothing and eye protection.

  All aspect of the "Herbicide Handling Procedures and Spill Contingency Plan" would be followed. These documents are contained in **Appendix S**.

3.6 Transportation and Traffic

This section assess impacts of the EDCP to transportation and traffic in the delta. Baseline information on transportation and traffic in the Delta is presented in Section 2.6 of Chapter 2.

The impacts analysis includes consideration of the issues identified within the Environmental Checklist (contained as Appendix I in the CEQA Guidelines), which lists the following potential concerns relating to transportation problems: Would the proposal result in:

a) Increased vehicle trips or traffic congestion;

b) Hazards to safety from design features (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);

c) Inadequate emergency access or access to nearby uses;

d) Insufficient parking capacity on-site or off-site;

e) Hazards or barriers for pedestrians or bicyclists;

f) Conflicts with adopted policies supporting alternative transportation (e.g., bus turnout, bicycle racks); or

g) Rail, waterborne or air traffic impacts.

This focuses only on navigation and roadway travel within the project area. These two modes of transportation would be the only ones affected by EDCP activities. Other types of transportation, such as railway, aviation, bicycle, and pedestrian would not be affected by the EDCP.

3.6.1 Transportation Significance Threshold

Objective criteria for determining the significance of transportation impacts related to the proposed project were defined based on guidance from the CEQA Guidelines, Appendices G and I. Pursuant to Appendix G, A project will normally have a significant effect on the environment if it will:

- Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system; and
- Interfere with emergency response plans or emergency evacuation plans.

3.6.2 Environmental Impacts and Consequences of the EDCP on Transportation

A review of the proposed project activities revealed that the EDCP likely would have localized, short-term impacts to navigation and traffic in the immediate area of EDCP control efforts. Navigation conditions are typically related to the presence or absence of obstacles that impede or prevent travel on area waterways. Similarly, traffic conditions are typically associated with obstacles that impede or prevent vehicle travel on area roadways. Therefore, it is anticipated that direct operational effects of the project likely would be limited to short-term effects that EDCP activities might have upon localized navigation and transportation.

Project transportation impacts are typically construction-related, and since this project does not include any construction activities it is not expected to directly generate boat or vehicle traffic. Additionally, both short- and long-term project activities are intended to improve navigation in the project area through a reduction of *Egeria* in area waterways. These issues are discussed in the following sections.

Impacts to Roadways

Herbicide applications would require one or two field vehicles carrying support staff to travel on public and private roads and atop levee crowns to bring personnel to treatment sites. These vehicles would be small enough in size and number to not pose any impacts to transportation in the area. In contrast, mechanical harvesting efforts would require operation of one or two field vehicles, a disposal vehicle, a bank side conveyor belt, and a vehicle to tow or transport this piece of equipment. These vehicles should pose no transportation impacts in rural areas with little to no traffic. Although, in locations where business, recreational, or agricultural activities are present, the DBW would modify or temporarily suspend EDCP operations to minimize or avoid transportation impacts in these areas.

Pre- and post-treatment monitoring of herbicide application and mechanical harvesting sites would also require the short-term presence of one or two field vehicles, but these vehicles should pose no impacts to transportation in the immediate area. Prior to the implementation of any EDCP field activities, the DBW would gain necessary right-of-way clearances to levees and properties traveled upon in order to carry out program actions. Overall, short-term, localized impacts to roadway travel as a result of EDCP activities likely would have a less than significant effect on roadway transportation in the project area.

Impacts to Navigation

EDCP activities would involve operation of two boats: a herbicide spray boat and field personnel transport craft. Herbicide treatments are expected to take from 4 to 8 hours to apply, depending on acreage. During applications, navigation in and adjacent to treatment sites would be limited to DBW craft. In locations where EDCP operations completely obstructed a waterway and no alternate route of travel was available for affected boaters, the DBW would temporarily suspend EDCP operations to allow passage of boats.

Mechanical harvesting at selected treatment sites is expected to take from 8 to 12 hours to complete, depending on acreage. During mechanical harvesting, navigation in and adjacent to treatment sites would be limited to DBW craft. Additionally, navigation upstream and downstream of mechanical harvest sites might be slightly interrupted due to *Egeria* fragment collection activities. As above, EDCP operations would be temporarily suspended to allow passage of boats in locations where mechanical harvesting completely obstructs navigation.

Pre- and post-treatment monitoring activities also would require short-term presence of boats at or near treatment sites, but these craft should pose no impacts to navigation. Overall, short-term, localized navigational impacts from either herbicide application or mechanical harvesting likely would have a less than significant effect on in the project area.

Boat traffic in the Delta is not expected to increase substantially due to improved navigational opportunities that result from successful implementation of the EDCP. While boater access to and from various locations would likely improve, the number of boats using the Delta is not expected to increase. One basis for this assumption is that a relatively small number of surface acres (1,500) would be treated each year. Overall, the EDCP would improve boat traffic in the Delta, by opening up channels for navigation. In conclusion, the EDCP would result in less than significant impacts to transportation and traffic.

3.6.3 Significance Determination for Transportation and Traffic

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- None.

Less than Significant Impacts

- Less than significant impacts to transportation and traffic due to the EDCP.

3.7 Recreation

This section assess impacts of the EDCP to recreational facilities or existing recreational opportunities. Baseline information on recreation and reacreation facilities is presented in Section 2.7 of Chapter 2.

According to the CEQA Guidlines, a project could significantly impact recreation if it would:

- Increase the demand for neighborhood or regional parks or other recreational facilities; or
- Affect existing recreational opportunities.

Impacts to recreation associated with EDCP activities should be limited to water-dependent recreational resources, therefore impacts to water-enhanced recreation will not be considered in this section.

3.7.1 Recreation Significance Threshold

Objective criteria for determining the significance of recreation impacts related to the proposed project were defined based on guidance from the CEQA Guidelines, Appendices G and I. Pursuant to Appendix G, "A project will normally have a significant effect on the environment if it will: (w) Conflict with established recreational, educational, religious, or scientific uses of the area." In addition, an impact is considered significant if implementing the proposed project would not support existing recreational goals and local planning policies.

3.7.2 Environmental Impacts/Consequences on Recreation

The EDCP likely would have localized, short-term, impacts on recreation in the immediate area of *Egeria* treatments. Water-dependent recreational activities such as boating, fishing, water skiing, and swimming could be temporarily limited, or precluded, for brief periods due to EDCP activities. Direct operational effects of the project likely would be limited to short-term effects that *Egeria* control treatments might have on localized recreational activities. Additionally, both short- and long-term project activities are intended to improve recreation in the project area through a reduction of *Egeria* biomass in area waterways.

Herbicide applications would involve operation of two boats: a herbicide spray boat and field personnel transport craft. Herbicide treatments are expected to take from 4 to 8 hours to apply, depending on acreage. During

applications, water-dependent recreational activities in and adjacent to treatment sites could be limited by authority of DBW staff. Mechanical harvesting at selected treatment sites is expected to take from 8 to 12 hours to complete, depending on acreage. During mechanical harvesting, water-dependent recreational activities in and adjacent to treatment sites could be limited or prohibited by authority of DBW staff. *Egeria* fragment collection upstream and downstream of mechanical harvest sites could interrupt water-dependent recreational activities in the immediate area. Pre- and post-treatment monitoring activities also would require the short-term presence of boats at or near treatment sites, and the presence of these craft could limit or prohibit certain recreational activities in the immediate area.

In conculsion, short-term, localized recreation impacts from either herbicide application or mechanical harvesting likely would have a less than significant effect on recreation in the project area. Potentially significant positive impacts on both water-dependent and water-enhanced recreation, stemming from a reduction in *Egeria* biomass in the project area, are possible.

3.7.3 Significance Determination for Recreation

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- None.

Less than Significant Impacts

- Less than significant impacts to recreation due to the EDCP.

3.8 Air Quality

This section assess impacts of the EDCP to air quality in the Delta. Air quality regulations and standards that apply to the EDCP are described. Impacts are analyzed by comparing these regulatory constraints to the air quality changes resulting from the EDCP. Baseline information on air quality is described in Section 2.8 of Chapter 2.

3.8.1 Air Quality Significance Threshold

Air pollutant emissions resulting from the EDCP would be significant if they exceeded any State or federal ambient air quality standards, or if they increased the severity of number of exceedences of ambient air quality standards. An impact to air quality is significant according to CEQA if it:

- Violates any air quality standard or contribute to an existing or projected air quality violation;
- Exposes sensitive receptors to pollutants;
- Alters air movement, moisture, or temperature, or cause any change in climate; or
- Creates objectionable odors.

The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) has a current policy of using a threshold of 10 tons of emissions per year per pollutant type, for reactive organic compounds (ROC), nitrogen oxides (NOx), and fine particulate matter (PM10) emissions in determining potentially significant air quality impacts of different proposed projects (under CEQA and NEPA). However, for determining the significance of CO, the SJVUAPCD uses the potential impacts of the project to create CO hot spots (that is, exceeding ambient CO standards at the local scale). An air quality impact also would be considered significant if it would "create objectionable odors," (CEQA Guidelines, Environmental Checklist Form).

Determination of general air quality is based on compliance with federal and State emission standards established for specific benchmark pollutants. At the federal level, the National Ambient Air Quality Standards (NAAQS) set emission limits for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and suspended particulate matter. California also has set emission standards for the pollutants identified by the NAAQS, when it adopted the California Ambient Air Quality Standards (CAAQS). In addition to the pollutants identified in the NAAQS, the CAAQS sets emission limits for sulfates, hydrogen sulfide, and visibility.

If a pollutant concentration exceeds any of these NAAQS or CAAQS standards in a basin or subregions of a basin, then that area is designated "non-attainment" for that pollutant. The NAAQS generally can be exceeded no more than once per year for short-term standards and not at all for annual standards. The CAAQS are not to be equaled or exceeded for either short-term or annual standards. Both the federal and State Clean Air Acts require basins that do not meet those standards to prepare a plan for bringing the area into compliance. The EDCP project area is located within three neighboring air basins: Sacramento Valley, San Francisco Bay Area, and San Joaquin Valley.

Sensitive Receptors

Sensitive populations (i.e., sensitive receptors) are more susceptible than the general population to the effects of air pollution. The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 4103 defines sensitive receptors as: schools, day care facilities, hospitals, health care facilities, convalescent homes, senior residence facilities, or those otherwise specified by the SJVUAPCD. Sensitive receptors close to localized sources of toxics and CO are of particular concern. For purposes of impact assessment, sensitive receptors are expanded to include residences, playgrounds, rehabilitation centers, and athletic facilities.

Residences are the only sensitive receptors located near proposed EDCP control areas. The EDCP project area is generally rural agricultural land with very minor residential development. Most residences in the project area are isolated, single family dwellings, often associated with agricultural operations. Discovery Bay, Bethal Island, Hotchkiss Tract/Sandmound Slough, and Fourteenmile Slough represent the only localities in the project area with low to moderate residential development.

3.8.2 Environmental Impacts /Consequences on Air Quality

EDCP activities include short-term operation of boats, mechanical harvesters and associated equipment, disposed vehicles, and field support vehicles. Localized, short-term air emissions from a small number of gas and diesel powered engines associated with the above equipment are not anticipated to significantly impact long-term air quality in the project area. Due to the limited number of personnel required for EDCP control activities, the EDCP would not contribute significantly to the number of vehicles in the project area. However, disposal of harvested *Egeria* on nearby agricultural lands may generate odors for a short period of time following disposal (caused by the decomposition of the plant and associated biota), that could affect nearby residents.

Reward and Sonar

Application of herbicides to EDCP sites would involve the operation of two boats: a herbicide spray boat, and field personnel transport craft. Additionally, one or two field vehicles carrying support staff would travel on public and private roads and atop levee crowns to bring personnel to the site. Pre- and post-treatment monitoring activities also would require short-term presence of boats and field vehicles at sites.

EDCP boat and vehicle operations are not anticipated to significantly alter ambient air quality conditions in the project area. EDCP operations likely would contribute far fewer emissions/pollutants to the project area than local agricultural operations, and existing boat and roadway traffic. EDCP activities would occur during daytime working hours to minimize potential exposure of sensitive receptors (i.e., local residents) to pollutants. In conclusion, adverse air quality impacts associated with herbicide applications would be less than significant.

Mechanical Harvesting

Mechanical harvesting of *Egeria* in the project area would include operation of a mechanical harvesting boat, plant material shuttle boat, bank side plant conveyor, disposal vehicle for transporting harvested plant material to an appropriate disposal site, and one or two field personnel transport boats. Additionally, one or two field vehicles carrying support staff would travel on public and private roads and atop levee crowns in order to bring personnel to both the mechanical harvesting and *Egeria* disposal sites. Pre- and post-treatment monitoring activities also would require short-term presence of boats and field vehicles at treatment sites. EDCP boat, equipment, and vehicle operations are not anticipated to significantly alter ambient air quality conditions in the project area. EDCP operations likely would contribute fewer emissions/pollutants to the project area than local agricultural operations, and existing boat and roadway traffic. EDCP activities would be limited to daytime working hours to minimize potential exposure of sensitive receptors (i.e., local residents) to pollutants.

Disposal of harvested *Egeria* fragments on nearby agricultural lands could generate unpleasant odors for brief periods while the plant and associated biota undergo decomposition. Spreading *Egeria* into low-lying piles atop the soil can enhance its breakdown. Turning over the *Egeria* after it is deposited, or tilling it into the soil, also would hasten its decomposition and limit unpleasant odors. The DBW would make an effort to dispose of *Egeria* in locations that minimize potential exposure of sensitive receptors (i.e., local residents) to objectionable odors. In conclusion, air quality impacts associated with mechanical harvesting are anticipated to be less than significant.

Overall Impacts of the EDCP on Air Quality

Air quality is not expected to be adversely affected by improved navigational opportunities that result from successful implementation of the EDCP. While boater access to and from various locations is expected to improve, the number of boats using the Delta is not expected to increase. Thus, the total quantity of exhaust expelled from motor boats each year is not expected to increase as a result of the EDCP. The EDCP could potentially result in a small net improvement in air quality, since EDCP improvements to navigation would alleviate the need for boaters to detour around beds of *Egeria*. In conclusion, the EDCP would result in less than significant impacts to air quality.

3.8.3 Significance Determination

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- None.

Less than Significant Impacts

- Less than significant impacts to air quality due to the EDCP.

3.9 Mineral Resources

This section assess impacts of the EDCP to mineral resources of the Delta. Baseline information on mineral resources is described in Section 2.9 in Chapter 2..

CEQA requires that an EIR evaluate the energy requirements and conservation potential of proposed projects (CEQA Guidelines Appendix F). The CEQA Checklist Form asks would the proposal:

a) Conflict with adopted energy conservation plans;

b) Use non-renewable resources in a wasteful and inefficient manner; or

c) Result in the loss of availability of a known mineral resource that would be of future value to the region and the residents of the State.

This discussion focuses on use of gasoline to run boats and personal watercraft, and use of diesel fuel and electricity to operate pumps used to withdraw and convey water from one location to another.

3.9.1 Mineral Resources Significance Threshold

Objective criteria for determining the significance of energy impacts related to the proposed project were defined based on guidance from the CEQA Guidelines, Appendices F and G. Pursuant to Appendix G, A project will normally have a significant effect on the environment if it will:

- Encourage activities which result in the use of large amounts of fuel, water, or energy; and
- Use fuel, water, or energy in a wasteful manner.

3.9.2 Environmental Impacts/Consequences to Mineral Resources

Current Energy Use

The significant growth and spread of *Egeria densa* in the sloughs and channels of the Sacramento-San Joaquin Delta during the 1990s has produced various navigational impairments for boaters and other recreational users of Delta waterways. In a number of locations within the project area, *Egeria* infestations force boaters to detour around navigational hazards created by the weed. While it is impossible to quantify the collective increase in gasoline consumption by boaters who take alternate travel routes to avoid contact with dense *Egeria* infestations, it is reasonable to believe that overall gasoline

consumption in the project area has increased due to the heightened presence of the plant during the past decade. Additional energy resources are also expended when boat towing services are required to transport "stranded" watercraft that have become incapacitated (typically a fouled motor) due to contact with *Egeria* infestations.

Furthermore, dense stands of the submerged plant, in combination with floating plant fragments, have obstructed water diversion structures, such as agricultural and municipal water intakes and State Water Project and Central Valley Project pumping facilities, thus impeding water conveyance. The obstruction of small water diversion structures and pumps with *Egeria* fragments increases the consumption of diesel fuel and electricity used to operate these pumps. Decreased flows through these structures require increased pumping, and thus increased energy consumption, in order to convey needed water supplies. A similar situation occurs at State and federal water pumping facilities. However, partial or total suspension of pumping operations at these facilities often leads to energy consumption conflicts with municipal users. Since most State and federal water pumping occurs "off peak" at night or on weekends, reduction or suspension of pumping caused by *Egeria* fragments requires these facilities to pump "on peak" to recover the water that was not able to be pumped off peak. This on peak pumping occurs when municipal electricity demand and consumption are at their highest.

Energy Demand Impacts

EDCP activities are not expected to use non-renewable resources in a wasteful and inefficient manner. In fact, long-term project activities may lead to a decrease in energy consumption by boaters and water diverters in the project area due to a reduction in abundance of *Egeria*.

Short-term operation of boats, mechanical harvesters, and associated equipment, disposal vehicles, and field support vehicles during EDCP activities would not result in either the consumption of large amounts of fuel, water, or energy, or the wasteful use of these resources. However, it is likely that long-term control of *Egeria* in the project area would result in a proportionate reduction in energy consumption due to decreased fuel and electricity use by boaters and water diverters. This potential reduction in energy consumption cannot be quantified due to difficulties in tracking fuel consumption by boaters and other recreational users of Delta waterways, and determining which of several variables associated with pumping water is responsible for an observed decrease in energy consumption. Overall, EDCP activities likely would have a less than significant positive impact on energy resources in the project area.

3.9.3 Significance Determination for Mineral Resources

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- None.

Less than Significant Impacts

- Less than significant impacts to mineral resources due to the EDCP.

3.10 Noise

This section addresses the EDCP's impacts to noise levels in the Delta. Baseline information on existing noise conditions in the Delta are presented in Section 2.10 of Chapter 2.

According to CEQA Guidelines, a project may significantly impact noise levels if it would:

- Increase existing noise levels, and
- Expose people to severe noise levels.

3.10.1 Noise Significance Criteria

The criteria used to determine whether identified impacts are significant and adverse were developed through a review of CEQA Guidelines. Noise levels resulting from the EDCP would be significant if they would increase existing noise levels or expose people to severe noise levels. Pursuant to Appendix G of the CEQA Guidelines, "A project will normally have a significant effect on the environment if it will increase substantially the ambient noise levels for adjoining areas."

3.10.2 Environmental Impacts/Consequences on Noise

EDCP activities are not expected to produce any long-term increases in existing noise levels. However, certain project activities may result in temporary elevated noise levels that could affect residents in the vicinity. These issues are discussed in the following sections.

Herbicide Applications

Application of herbicides to *Egeria* sites would involve the operation of two boats: a herbicide spray boat and field personnel transport craft. Additionally, one or two field vehicles carrying support staff would travel on public and private roads and atop levee crowns in order to bring personnel to the treatment site. Pre- and post-treatment monitoring activities also would require short-term presence of boats and field vehicles at treatment sites. Project-related boat and vehicle traffic would not create significant increases in noise levels beyond the ambient noise levels produced by local agricultural operations, and existing boat and roadway traffic. Also, EDCP activities would occur during daytime working hours to minimize potential disturbances to any adjacent residents. In conclusion, adverse noise impacts ass ciated with herbicide applications would be less than significant.

Mechanical Harvesting

Mechanical harvesting of *Egeria* in the project area would involve the operation of a mechanical harvesting boat, plant material shuttle boat, bank side plant conveyor, disposal vehicle for transporting harvest plant material to an appropriate disposal site, and one or two field personnel transport boats. Additionally, one or two field vehicles carrying support staff would travel on public and private roads and atop levee crowns to bring personnel to both the mechanical harvesting and plant disposal sites. Pre- and post-treatment monitoring activities also would require the short-term presence of boats and field vehicles at treatment sites. Project-related boat, equipment, and vehicle traffic would not create significant increases in noise levels beyond the ambient noise levels produced by local agricultural operations, and existing boat and roadway traffic. Also, EDCP activities would occur during daytime working hours to minimize potential disturbances to any adjacent residents. In conclusion, adverse noise impacts associated with mechanical harvesting would be less than significant.

3.10.3 Significance Determination for Noise

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- None.

Less than Significant Impacts

- Less than significant impacts to noise levels due to the EDCP.

3.11 Geology and Soils

This section assess impacts of the EDCP to geological and soil conditions in the Delta. Baseline information on geology and soils is contained in Section 2.11 of Chapter 2. The CEQA guidelines indicate that a project may significantly impact geology and soils if it would result in or expose people to potential impacts involving:

a) Fault rupture

b) Seismic ground shaking

c) Seismic ground failure, including liquefaction

d) Seiche, tsunami, or volcanic hazard

e) Landslides or mudflows

f) Erosion, changes in topography or unstable soil conditions from excavation, grading, or fill

g) Subsidence of the land

h) Expansive soils

i) Unique geologic or physical features.

3.11.1 Geology Significance Threshold

Objective criteria for determining the significance of geologic impacts related to the proposed project were defined based on guidance from the CEQA Guidelines, Appendices G and I. Pursuant to Appendix G of the CEQA Guidelines, A project will normally have a significant effect on the environment if it will:

- Cause substantial flooding, erosion, or siltation, and
- Expose people or structures to major geologic hazards.

3.11.2 Environmental Impacts and Consequences of the EDCP on Geology

The EDCP does not include grading or excavation of geologic materials, or construction of any facilities that could be affected by seismic activity. Project activities would not expose people to potential impacts involving fault rupture, seismic disturbance, landslides or mudflows, subsidence, or expansive soils. The only geologic problems that may result from EDCP activities are minor disturbance and erosion of levee bank soils resulting from placing plant conveyance equipment on levee banks during mechanical harvesting.

Mechanical harvesting of *Egeria* at sites in the project area requires temporary placement of a motor-powered conveyor belt on a nearby levee bank to facilitate the off-loading of harvested plant material from the shuttle boat to a disposal vehicle. The temporary placement of the conveyor apparatus on the levee bank likely would result in a minor disturbance of bank soil. Minor erosion of bank soil likely could occur as water drains from the harvested plant material onto the levee bank and back into the channel. Placement and operation of conveyor machinery is not expected to otherwise affect the levee bank or water's edge.

Mechanical harvest trials conducted in 1997 and 1998 revealed that placing conveyor machinery on levee banks caused very minimal localized bank soil disturbance. Additionally, erosion of levee bank soil due to the draining of harvested plant material appeared to be less than or equal in magnitude to erosion that occurs as a result of a moderate rain shower. Draining water from harvested plant material deposited in the back of a disposal vehicle did not erode soil on the levee crown (on top of which the truck was temporarily parked). Ultimately, the conveyor machinery would not be placed on a levee bank at a specific location that would potentially result in significant soil erosion or disturbance. In conclusion, soil erosion and disturbance impacts associated with mechanical harvesting would be less than significant.

3.11.3 Significance Determination for Geology and Soils

Unavoidable Significant Impacts

- None.

Avoidable Significant Impacts

- None.

Less than Significant Impacts

- Less than significant impacts to geology and soils due to the EDCP.

3.12 Land Use and Planning

The following briefly discusses the basis for the conclusion that the EDCP would not impact land use and planning in the Delta. Baseline information on land use and planning is presented in Section 2.12 of Chapter 2.

According to the CEQA Checklist, a project may significantly impact land use and planning if it:

- Physically divided an established community;
- Conflicted with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigation an environmental effect; or
- Conflicted with any applicable habitat conservation plan or natural community conservation plan.

The EDCP would not result in any of these impacts. Project activities would not divide any established communities, nor would they conflict with any land use plans, policies or regulations. (The project would result in avoidable impacts to agricultural resources, however these impacts are discussed under Agricultural Resources, Section 3.3.) There are no applicable habitat conservation plans or natural community conservation plans in the project area. (Project related impacts to habitat would occur, however these are discussed under Biological Resources, Section 3.2.) In conclusion, the EDCP would not impact land use and planning in the Delta.

3.13 Public Services

The following briefly discusses the basis for the conclusion that the EDCP would not impact public services in the Delta. Baseline information on public services in the Delta is presented in Section 2.13 of Chapter 2.

According to the CEQA Checklist, a project may significantly impact public services if it:

- Resulted in the need for new or physically altered government facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for public services, such as fire protection, police protection, schools, parks, other public facilities.

The EDCP would not result in the need for new or altered public service facilities, since no significant increases in the resident population or number of people utilizing the Delta are expected to occur as a result of the EDCP. In conclusion, the EDCP would not impact public services in the Delta.

3.14 Population and Housing

The following briefly discusses the basis for the conclusion that the EDCP would not impact population and housing in the Delta. Baseline information on population and housing is presented in Section 2.14 of Chapter 2.

According to the CEQA Checklist, a project may significantly impact population and housing if it:

- Induced substantial population growth in an area, either directly or indirectly;
- Displaced substantial numbers of existing houses, necessitating the construction of replacement housing elsewhere; or
- Displaced substantial numbers of people, necessitating the construction of replacement housing elsewhere.

No significant increases in population growth are anticipated as a result of improvements to navigational opportunities in the Delta brought about by the EDCP. Improved navigation may increase use of certain businesses that occur along the channels of the Delta. This in turn could result in a small increase in local population, although this statement is purely speculative. However, the scope of the project (treatment of approximately 1,500 acres per year) is so small, that increases in population would be less than significant. In conclusion, the EDCP would not impact population and housing.

3.15 Cultural Resources

The following briefly discusses the basis for the conclusion that the EDCP would not impact cultural resources in the Delta. Baseline information on cultural resources is presented in Section 2.15 of Chapter 2.

According to the CEQA Checklist, a project may significantly impact cultural resources if it:

- Caused a substantial adverse change in the significance of a historical resource;
- Caused a substantial change in the significance of an archaeological resource;
- Directly or indirectly destroyed a unique paleontological resource or site or unique geologic feature; or
- Disturbed any human remains, including those interred outside of formal cemeteries.

The EDCP would not occur in the vicinity of any historical, archaeological, or paleontological resources, unique geologic features, or areas where human remain may be interred. Further, project activities are focused in channels and sloughs, and thus would not result in disturbances to land or soils where such resources or remains may occur. In conclusion, the EDCP would not impact cultural resources.

3.16 Aesthetics

The following briefly discusses the basis for the conclusion that the EDCP would not impact aesthetics of the Delta. Baseline information on aesthetics is presented in Section 2.16 of Chapter 2.

According to the CEQA Checklist, a project may significantly impact aesthetics if it:

- Had a substantial adverse effect on a scenic vista;
- Substantially damaged scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway;
- Substantially degraded the existing visual character or quality of the site or its surroundings; or
- Created a new source of substantial light or glare, which would adversely affect day or nighttime views in the area.

The EDCP would not impact scenic views or resources, or create a new source of light or glare, since project operations would be focused on the water column. (Control of Egeria may be considered to improve the existing visual quality of various sites in the Delta.) In conclusion, the EDCP would not impact aesthetics of the Delta.