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Environmental Impact Report for the Prospect Island Tidal Habitat Restoration Project

Draft Environmental Impact Report for the Prospect Island Tidal Habitat Restoration Project

Prepared by:
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West Sacramento, CA

and

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Stockton, CA

August 2016

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Pursuant to:
California Environmental Quality Act, P.R.C. 21000 et seq.; State of California Guidelines, California Administrative Code, 15000 et seq.

Lead Agency:
California Department of Water Resources

I approve this draft for public review,

Dean F. Messer, Division Chief
Division of Environmental Services
California Department of Water Resources

Date: 8/9/16

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The Prospect Island Tidal Habitat Restoration Project Environmental Impact Report is being made available to the public in accordance with the California Environmental Quality Act.

Visit the Prospect Island Tidal Habitat Restoration Project Web Site (http://www.water.ca.gov/environmentalservices/frpa_prospect_restoration.cfm) where you can:

- View and download an electronic copy of the Draft EIR.
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Printed copies also have been placed at the Solano County Recorder's Office.

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ac	acre
AQAP	air quality attainment plan
BDCP	Bay Delta Conservation Plan
BiOps	Biological Opinions
BMP	Best Management Practice
^{o}C	Degrees Celsius
CAAQS	California Ambient Air Quality Standards
CALFED	CALFED Bay-Delta Program
CAL FIRE	California Department of Forestry and Fire Prevention
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CCR	California Code of Regulation
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CDPR	California Department of Pesticide Regulation
CEQA	California Environmental Quality Act
CERLA	Comprehensive Environmental Response, Compensation, and
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
CRHR	California Register of Historical Resources
CRPR	California Rare Plant Ranks
CSC	Cache Slough Complex
CSLC	California State Lands Commission
CVFPB	Central Valley Flood Protection Board
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DBW	Division of Boating and Waterways
DCC	Delta Cross Channel

Acronym	Definition
Delta	Sacramento-San Joaquin River Delta
DOC	dissolved organic carbon
DOGGR	Division of Oil, Gas, and Geothermal Resources
DPC	Delta Protection Commission
DPM	diesel particulate matter
DPR	Department of Parks and Recreation
DPS	distinct population segments
DRERIP	Delta Regional Ecosystem Restoration Implementation Plan
DRMS	Delta Risk Management Strategy
DSC	Delta Stewardship Council
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
DWSC	Sacramento Deep Water Ship Channel
EC	electrical conductivity
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
°F	Degrees Fahrenheit
FCAA	Federal Clean Air Act
FEMA	Federal Emergency Management Agency
FGC	Fish and Game Code
FHWA	Federal Highway Administration
fps	Foot or feet per second
FRP	Fish Restoration Plan
ft	feet
GGERP	Greenhouse Gas Emissions Reduction Plan
GHG	greenhouse gas
IEP	Interagency Ecological Program
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HSC	Health and Safety Code
HU	hydrogeologic unit
in	inch
LGP	low ground pressure
LURMP	Land Use and Resource Management Plan
MBTA	Migratory Bird Treaty Act

Acronym	Definition
MCL	maximum contaminant level
MeHg	methylmercury
MHW	mean high water
MHHW	mean higher high water
MLW	mean low water
MLLW	mean lower low water
MPH	miles per hour
MTL	mean tide level
MSDS	material safety data sheets
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NBA	North Bay Aqueduct
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOP	Notice of Preparation
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NPPA	Native Plant Protection Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Units
NWIC	Northwest Information Center
O_3	ozone
OCAP	Operations Criteria and Plan
OHP	Office of Historic Preservation
OPR	Office of Planning and Research
OSHA	Occupational Safety and Health Administration
Pb	lead
PCB	polychlorinated biphenyls
PCE	Primary Constituent Element
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter

Acronym	Definition
Port	Port of West Sacramento
ppt	parts per thousand water
PRC	Public Resources Code
RCRA	Resource Conservation and Recovery Act
RD	Reclamation District
RIAR	Ryer Island Agricultural Region
RHA	Rivers and Harbors Act
ROG	Reactive Organic Gases
RV	recreational vehicle
RWQCB	Regional Water Quality Control Board
SDWA	Safe Drinking Water Act
SFCWA	State and Federal Contractors Water Agency
SIP	State Implementation Plan
SHPO	California State Historic Preservation Officer
SMARA	Surface Mining and Reclamation Act
SO_2	sulfur dioxide
SR	state route
SRA	shaded riverine aquatic
SRFCP	Sacramento River Flood Control Project
SVAB	Sacramento Valley Air Basin
SWA	State Wildlife Area
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SWS	Stillwater Sciences
TAC	Toxic Air Contaminant
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TSCA	Toxic Substances Control Act of 1976
TTLC	total threshold limit concentration
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDR	Waste Discharge Requirement
WWR	Wetlands and Water Resources
YSAQMD	Yolo-Solano Air Quality Management District

SUMMARY

The Prospect Island Tidal Habitat Restoration Project (Project) is an approximately 1,600-acre (ac) tidal restoration Project located in southeastern Solano County proposed by the California Department of Water Resources (DWR). DWR is the CEQA Lead Agency for this Project.

Project Area

Prospect Island is located immediately east of, and technically is still an element of, the southern end of the Yolo Bypass in the Sacramento-San Joaquin River Delta. The site is bounded on the east by Miner Slough, on the west by the Sacramento Deep Water Ship Channel (DWSC), on the south by the confluence of the DWSC and Miner Slough, and on the north by an east-west levee that runs from Arrowhead Harbor Marina to the DWSC. Both the northern, 1,300-ac portion and the southern, 300-ac portion of Prospect Island are owned by DWR.

Project Goals and Objectives

The overarching goal of the Project is to restore tidal action to the interior of Prospect Island. The Project is intended to partially fulfill the 8,000-ac tidal habitat restoration obligations of DWR contained within Reasonable and Prudent Alternative (RPA) 4 of the U.S. Fish and Wildlife Service (USFWS) Delta Smelt Biological Opinion (BiOp) for long-term coordinated operations of the State Water Project (SWP) and the federal Central Valley Project (CVP) (USFWS 2008). Because restoration of tidal habitat would provide access for salmonid rearing at Prospect Island, the Project would also be consistent with RPA I.6.1 of the National Marine Fisheries Service (NMFS) Salmonid BiOp for SWP/CVP operations (NMFS 2009a).

The Notice of Preparation (NOP) identified the following six objectives for the Project (DWR 2013):

1. Enhance primary and secondary productivity and food availability for Delta Smelt and other native fishes within Prospect Island and surrounding Delta waterways.
2. Increase the quantity and quality of salmonid rearing habitat within and in the areas surrounding Prospect Island.
3. Increase the amount and quality of habitats to support other listed species, to the extent they can be supported by site conditions and natural processes.

4. Provide other ecosystem benefits associated with increased Delta freshwater tidal marsh habitat, including water quality enhancement, recreation, and carbon sequestration.
5. To the greatest extent practical, promote habitat resiliency to changes in future Delta conditions, such as land use conversions, climate change, sea level rise, and invasive species.
6. Avoid promoting conditions adverse to Project biological objectives, such as those that would favor establishment or spread of invasive exotic species.

Proposed Project

Under the Proposed Project, the Miner Slough levee would be breached in two locations: one in the north property approximately 0.5 miles south of Arrowhead Harbor Marina and one in the south property at the location of the formerly repaired breach connecting to the Miner Slough spur channel. A portion of the internal cross levee separating the north and the south properties would also be removed. Once these breaches were completed, the north and south properties would be subject to daily tidal inundation. Briefly, the Proposed Project would include the following actions:

1. Pre-construction site preparation;
2. Invasive species control;
3. Old infrastructure and debris removal;
4. Excavation of tidal slough channels;
5. Placement of excavated soils into selected remnant agricultural ditches;
6. Placement of excavated soils into the site interior;
7. Placement of excavated soils to construct a gently sloped eastern toe berm on the interior side of the eastern Miner Slough levee;
8. Placement of excavated soils to construct an eastern intertidal bench in areas interior to the Miner Slough levee and adjacent to subtidal areas;
9. Removal of a portion of the internal cross levee;
10. Excavation of two levee breaches to Miner Slough;
11. Placement of excavated soils into the site interior at levee breach locations; and,
12. Dredging of the spur channel between Miner Slough and the south property and placement of dredged material within Prospect Island (if it meets sediment quality standards).

Summary of Impacts and Mitigation Measures

The primary impacts under the Proposed Project would be short-term impacts due to construction-related activities. These include impacts to water quality, air quality, special status species and their habitat, recreational boating activities, visual aesthetics, and noise disturbance to sensitive receptors. With the exception of short-term impacts to perennial aquatic habitats and wetland communities from site dewatering (Impact 3.4-1) and generation of pollutant (i.e., NOx) emissions that would contribute to air quality violations (Impact 3.7-1) and conflict with regional air quality plans (Impact 3.7-2), implementation of associated mitigation measures would reduce short-term impacts to less than significant (Table ES-1).

Table ES-1. Summary of Impacts and Mitigation Measures

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
		HYDROLOGY	
3.1-1	Potential changes in agricultural water supply and drainage due to changes in tidal range	LTS	None required
3.1-2	Potential impacts to Sacramento River Flood Control Project and Yolo Bypass Floodway flood conveyance	NI	None required
3.1-3	Groundwater seepage impacts from Prospect Island to adjacent areas	LTS	None required
3.1-4	Potential wind-wave erosion of the interior side of Prospect Island levees	LTS	None required
3.1-5	Potential toe-scour and erosion of Miner Slough levees affecting Ryer Island levee stability	LTS	None required
3.1-6	Potential increase in seepage on adjacent lands due to Miner Slough bed scour	LTS	None required
3.1-7	Potential impacts to regional flow resulting in non-compliance with D-1641 flow requirements on the Sacramento River at Rio Vista	NI	None required
3.1-8	Potential scour impacting stability of nearby bridges, trestles, culverts or other structures	NI	None required
3.1-9	Potential impacts to water rights from diversion of surface water	NI	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.1-10	Potential construction related impacts to groundwater supplies and third party wells	NI	None required
		WATER QUALITY	
3.2-1	Short-term construction-related water quality impacts	LTSM	**Mitigation Measure 3.2-1.1** A site dewatering plan shall be developed by the construction contractor and submitted to DWR for approval prior to commencement of construction activities. The site dewatering plan shall shall include items such as the following: • Detailed description of work to be performed to control surface water at the Project site. • Detailed description of methods, installation and details of the dewatering systems proposed to be used. • Drawings showing the detailed layout of dewatering systems including pumps, ditches, berms, discharge lines, BMPs, and barriers to shield or divert flow. • Supporting design information including design calculations prepared by a California Registered Civil Engineer, type of systems, sizes, capacities, proposed number and layout of pumps, depths, filters, other needed equipment, and power supply. • Information related to backup pumping systems, backup power systems, and warning systems to protect against power failure, system failure, and high groundwater. • Information related to operation, maintenance, monitoring, removal, decommissioning pumps, and system abandonment procedures. • Information related to discharge including methods to monitor turbidity and water treatment if necessary. • Provisions for handling significant rainfall events (greater than 0.5 inches predicted in a 24-hour period as described in the SWPPP). This shall also include procedures to be followed prior to the forecasted significant rain events. • Provisions for handling emergency situations such as power outages, equipment failures, pumping system shutdowns and the proposed response. • Information on schedule and sequencing of dewatering activities. • Information on dewatering operations shall be coordinated with other construction operations including placement of compacted soil, removal and placement of pipe, and other miscellaneous items.

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
			Mitigation Measure 3.2-1.2 Upland areas of the Proposed Project associated with staging activities shall be covered by a Stormwater Pollution Prevention Plan (SWPPP). All contractors working in a capacity that could increase the potential for adverse water quality impacts would receive training regarding the need to minimize impacts. Contractors would also be familiar with general storm water construction-site BMPs for the protection of water quality. The SWPPP may include, but would not be limited to, the following: 1. Use of vegetated buffers, hay wattles or bales, sandbags, silt screens, or other erosion control measures to intercept runoff from construction, excavation, or staging areas to adjacent waterbodies. 2. BMPs for staging of construction supplies and waste management. **Mitigation Measure 3.2-1.3** A Spill Prevention, Control, and Response Plan shall be developed by the construction contractor and submitted to DWR for approval prior to commencement of construction activities. Spill prevention and cleanup kits, equipment, and materials shall always be in close proximity to locations of hazardous materials (e.g., at fueling and staging areas) and conveniently located to allow rapid response. Prior to entering the work site, all field personnel would be informed of the location of the spill prevention and cleanup kits and appropriately trained in spill prevention, hazardous material control, and spill cleanup. The work site would be routinely inspected to verify that the Plan is properly implemented. The Plan would include: 1. A vehicle inspection and fueling plan. 2. BMPs for spill prevention and containment. 3. Locations and uses of spill prevention materials, cleanup kits, and equipment. 4. Qualification and reporting requirements for a federal reportable spill (40 CFR 110) including contact information for the RWQCB and the California Department of Toxic Substances Control (DTSC).

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.2-2	Short-term construction-related increases in turbidity from dredging and excavation of levee breaches	LTSM	**Mitigation Measure 3.2-2.1** 1. Appropriate turbidity control measures (e.g., silt curtains) shall be required during all dredging operations. Selection of appropriate turbidity control measures would consider tidal forces in Miner Slough and would be designed to be robust and effective. Turbidity measures would be in place 1–2 days prior to commencement of dredging operations and would be positioned slightly above the bottom sediments allowing aquatic species to escape entrapment. 2. The cycle time of the ascending loaded dredging bucket shall be limited to a velocity that reduces the potential to wash sediment out of the bucket. 3. The number of bites performed per cycle shall be limited to 1 to reduce sediment re-suspension from opening and closing the dredging bucket.

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.2-3	Short-term construction-related effects from application of aquatic herbicides	LTSM	**Mitigation Measure 3.2-3.1** Best Management Practices (BMPs) shall be employed in order to minimize potential impacts to water quality from accidental spills. All contractors working shall receive training regarding the need to minimize impacts. Contractors shall be experienced and compliant in the environmentally-safe application of herbicides. BMPs shall include, but not be limited to, the following: 1. Areas for storage, mixing, and loading of herbicides shall be located where accidental spills to nearby waterbodies cannot occur. 2. Applicators shall be trained in proper spill response, and rapidly report any spill to the appropriate agencies. 3. Applicators shall maintain on-site (near herbicide storage and loading equipment) appropriate initial spill-response items (e.g., absorbent materials). **Mitigation Measure 3.2-3.2** In order to minimize off-target spray drift and impacts to water quality from herbicide application, aerial pesticide application by helicopter shall be preferred (over fixed wing aircraft). In addition, all appropriate, standard BMPs for aerial application of pesticides shall be followed, including but not limited to, the following: 1. Applicators shall develop an application plan--including maps of the Project site showing general spotter and flight plans with application areas clearly indicated--to be approved by DWR, before any application of herbicides. 2. Applicators shall adhere strictly to proper mixing and application guidelines as presented on herbicide labels and in product instructions. 3. Application of herbicides on levee vegetation shall not take place by air and otherwise avoided unless necessary, when it would be executed using spot application techniques. 4. Herbicide application by air shall only take place from July 1 to October 31 of any one year, in order to reduce potential impacts to migrating fish species of concern. 5. Applicators shall maintain records of herbicide applications—including dates, times, weather conditions, amount of herbicide applied, problems experienced, etc.— in addition to or as required by federal, state, and/or local agencies. 6. Spraying shall at all times be halted when flying over levees, adjacent waterbodies (i.e., Miner Slough, DWSC), and agricultural fields. 7. Aerial application would occur only during light winds, non-gusty, relatively cool weather conditions. 8. Application would involve the use of appropriate spray nozzles, nozzle configurations, and nozzle orientations that minimize atomization of herbicide mixtures and production of fine droplets that tend to drift. 9. Herbicide tanks would not be operated at excessively high pressures. 10. If conditions require the use of aerial spray by fixed-wing aircraft, pilots shall be instructed to include an appropriate spray buffer (in addition to the width of the levee) where, to the extent possible, no herbicides would be directly applied (subject to overriding safety concerns).

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.2-4	Short-term construction-related effects on water temperature in adjacent waterbodies due to dewatering activities	NI	None required
3.2-5	Long-term effects on salinity in waterbodies near Prospect Island	LTS	None required
3.2-6	Long-term effects on water temperature within Prospect Island and in nearby waterbodies	B	None required
3.2-7	Long-term effects on primary productivity and dissolved organic carbon (DOC) within and near Prospect Island	LTS	None required
3.2-8	Long-term effects on methylmercury production and bioaccumulation	LTS	None required
3.2-9	Potential effects on groundwater quality	NI	None required
AQUATIC BIOLOGICAL RESOURCES			
3.3-1	Short-term loss and degradation of aquatic habitat from construction-related activities	LTS	None required
3.3-2	Long-term conversion and enhancement of aquatic habitat	B	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.3-3	Short-term direct construction-related injury or mortality of fish	LTSM	**Mitigation Measure 3.3-3.1** Pile driving activities shall be conducted using vibratory hammers, where feasible, to minimize sound attenuation from pile driving activities. If in-water pile driving activities become necessary, underwater acoustic monitoring shall be performed at submerged pile driving locations to ensure that peak sound pressure does not exceed 206 decibels and accumulated sound exposure level does not exceed 187 decibels at 10 meters. If work is performed at a time when fish less than 2 grams are expected near the Project Site, accumulated sound exposure levels shall not exceed 183 decibels at 10 meters. Underwater sound reduction measures shall be implemented as needed to ensure that sound levels do not exceed the above thresholds. Sound reduction measures may include impact cushions, pipe caissons, bubble curtains, fabric barriers, and limiting operational hours and impact frequency. The acoustic monitoring plan shall be prepared by DWR. **Mitigation Measure 3.3-3.2** DWR shall consult with CDFW and USFWS before conducting any in-water work during the month of July. DWR shall determine the extent of Delta Smelt presence in the Cache Slough Complex and Miner Slough by evaluating catch and distribution data from CDFW's 20-mm Survey and Summer Townet Survey. The results shall be sent to USFWS and CDFW representatives to determine the extent of allowable in-water work. 20-mm Survey stations 724 and 726 are located in Miner Slough at the lower and upper ends of Prospect Island and shall be used to determine Delta Smelt abundance in Miner Slough during July construction activities. Summer Townet Survey Station 715, just downstream of Miner Slough in Cache Slough; Station 723, just upstream from Miner Slough in the DWSC; and Station 716, just upstream from Miner Slough in Lindsey Slough, shall be used to determine Delta Smelt abundance in the vicinity of Miner Slough when the 20-mm Survey is not active.
3.3-4	Short-term construction-related noise impediments to fish migration	LTSM	**Mitigation Measure 3.3-3.1** *(described above in Aquatic Biological Resources)*
3.3-5	Short-term impairment of essential fish behaviors due to potential increases in turbidity during underwater sediment sampling activities	LTS	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.3-6	Short-term impairment of essential fish behaviors due to construction-related increases in turbidity	LTSM	**Mitigation Measure 3.2-2.1** *(described above in Water Quality)*
3.3-7	Short-term fish injury or mortality during dewatering	LTSM	**Mitigation Measure 3.3-7.1:** To minimize mortality due to the dewatering process, a fish rescue plan shall be prepared by DWR for approval by the USFWS and CDFW and implemented during and potentially after dewatering. The fish rescue plan shall incorporate numerous sampling methods and events over an extended period of time to thoroughly rescue as many fish as possible. Fish would be captured alive and transported to nearby suitable habitat for release.
3.3-8	Fish Injury or mortality due to herbicide application	NI	None required
3.3-9	Post-construction increased predation on native fish	LTS	None required
3.3-10	Long-term impacts to fish in Prospect Island and adjacent water bodies from changes in water temperature	B	None required
3.3-11	Altered habitat and food web from invasion by Asian clam	LTS	None required
3.3-12	Food web impacts from increased levels of methylmercury bioaccumulation	LTS	None required
WETLAND AND TERRESTRIAL BIOLOGICAL RESOURCES			
3.4-1	Short-term impacts to perennial aquatic habitats and wetland communities from site dewatering	SU	
3.4-2	Short-term impacts to tidal aquatic habitats and wetland communities from dredging in the Miner Slough spur channel	NI	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.4-3	Short-term loss of valley/foothill riparian habitat	LTSM	**Mitigation Measure 3.4-3.1** Potential short-term impacts to individual high value trees for nesting and roosting would be minimized during final design by avoidance and protection measures.
3.4-4	Short-term construction-related mortality or detrimental effects to sensitive plants	LTSM	**Mitigation Measure 3.4-4.1** Mitigation shall include conducting pre-construction surveys for special-status plants. If special-status plants are found within the affected footprint, preservation methods such as transplantation, salvage, or seed collection and dispersal would be considered and shall be implemented if deemed necessary to avoid a significant impact to the local population through consultation with CDFW. Herbicide application practices shall include following all application recommendations for the herbicide to be applied, and refraining from applying product under wind conditions which would increase the likelihood for drift.
3.4-5	Long-term conversion of perennial aquatic habitats and wetland communities to tidal habitat types	LTS	None required
3.4-6	Long-term loss of valley/foothill riparian habitat	LTS	**Mitigation Measure 3.4-3.1** *(described above in Wetland and Terrestrial Biological Resources)*
3.4-7	Reduction in available habitat for special-status plant species adapted to current conditions	LTS	None required
3.4-8	Short-term construction-related impacts to valley elderberry longhorn beetle	LTSM	**Mitgation Measures 3.2-3.1 and 3.2-3.2** *(described above in Water Quality)*
3.4-9	Long-term impacts to valley elderberry longhorn beetle	NI	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.4-10	Short-term construction-related injury or mortality and loss of habitat for giant garter snakes	LTSM	**Mitigation Measure 3.4-10.1** This mitigation measure includes the following: 1. Require construction personnel to receive USFWS and CDFW-approved worker environmental awareness training to recognize giant garter snake and its habitat. 2. Install exclusion fencing around all staging areas and areas of construction to avoid attracting giant garter snake to the construction site. 3. Survey the site at least 24 hours prior to the initiation of ground-disturbing activities in suitable giant garter snake habitat. This survey shall be conducted by a USFWS and CDFW-approved biologist in suitable giant garter snake habitat. Surveys shall be repeated if a lapse in construction activity of two weeks or greater occurs. If giant garter snake is encountered during ground-disturbing activities, activities at that specific location shall cease until appropriate corrective measures, in concurrence with USFWS and CDFW coordination, have been completed or it has been determined that individual giant garter snakes would not be harmed. Sightings shall be reported to USFWS and CDFW. 4. Implement ground disturbing construction activity within giant garter snake habitat between May 1 and October 1. This is the active period for giant garter snake and direct mortality is lessened, because giant garter snakes are expected to actively move and avoid danger. DWR would contact the USFWS and CDFW to determine if additional measures are necessary to minimize and avoid take for work between October 2 and April 30. 5. Vehicle speeds shall not exceed 15 MPH to avoid hitting giant garter snakes and other special-status wildlife. 6. Remove temporary fill and construction debris after construction completion, and, wherever feasible, restore disturbed areas to pre-Project conditions.
3.4-11	Long-term conversion of giant garter snake habitat	LTS	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.4-12	Short-term construction-related habitat loss and injury or mortality of individual western pond turtles	LTSM	**Mitigation Measure 3.4-12.1** Prior to implementing construction activities and/or scheduled dewatering, a qualified biologist would survey areas in or adjacent to suitable western pond turtle aquatic habitat. Western pond turtles found in harm's way would be moved by a qualified biologist to a safe location outside of the work area in a manner consistent with applicable CDFW regulations. A qualified biologist would conduct periodic monitoring of suitable western pond turtle aquatic habitat until ground-disturbing/dewatering activities have ceased in those areas. This mitigation measure is consistent with Solano County's General Plan policies RS.P-1 through RS.P-9. **Mitigation Measure 3.2-1.2** *(described above in Water Quality)*
3.4-13	Long-term conversion of western pond turtle habitat	B	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.4-14	Short-term, construction-related injury or mortality, take of nests, and loss of nesting and foraging habitat of special-status and migratory birds	LTSM	**Mitigation Measure 3.4-14.1** This mitigation measure includes the following: 1. Site preparation and construction activities should take place outside of nesting season (February 15 – August 15) to avoid take via disturbance or destruction of nests or mortality of individuals. If work begins before this period and continues uninterrupted throughout the nesting season, the consistent disturbance may deter birds from nesting at the site and prevent take. 2. If work must take place during March 15 – August 15, a preconstruction survey would be conducted within 14 days prior to the initiation of construction activity by a qualified biologist to identify nesting Swainson's Hawks within ½ mile of the construction footprint. If active Swainson's Hawk nests are found, appropriate non-disturbance buffers and avoidance measures would be developed in coordination with CDFW to avoid disturbance of nesting Swainson's Hawks based on individual bird behavior and construction-related disturbance that occurs. Surveys shall be repeated if a lapse in construction of 14 days or greater occurs. Surveys would be repeated annually if work takes place during subsequent nesting seasons. 3. If work must take place during April 1 – August 31, a preconstruction survey would be conducted within 14 days prior to the initiation of construction activity to identify nesting raptors within 500 feet, and other nesting birds within 100 feet of the construction footprint. Appropriate non-disturbance buffers would be established until nestlings have fledged. Surveys shall be repeated if a lapse in construction of 14 days or greater occurs during the nesting season. Surveys would be repeated annually if work takes place during subsequent nesting seasons. 4. If work must take place during March 15 – August 15 and use of non-disturbance buffers is infeasible, a qualified biologist shall be on site to monitor active nests. Monitoring requirements would be established in coordination with CDFW. Monitors would have authority to stop work if it appears that Swainson's Hawk nests are disturbed by construction activity, and CDFW would be contacted for further guidance. 5. Remove or trim the minimal number of trees to satisfy the Project design. Trimming and removal would take place August 15 to February 15, outside of nesting season. 6. If construction activity results in take of individual birds or their nests, appropriate mitigation would be determined in coordination with CDFW. 7. Vehicle speed limits shall not exceed 15 MPH to avoid striking birds. 8. Remove temporary fill and construction debris after construction completion, and, wherever feasible, restore disturbed areas to pre-Project conditions. **Mitigation Measure 3.4-3.1** *(described above in Wetland and Terrestrial Biological Resources)*
3.4-15	Long-term conversion of nesting and foraging habitat for special-status and migratory birds	LTSM	**Mitigation Measure 3.4-3.1** *(described above in Wetland and Terrestrial Biological Resources)*

<table>
<tr><th>Impact No.</th><th>Impact Title</th><th>Significance</th><th>Proposed Mitigation Measures</th></tr>
<tr><td>3.4-16</td><td>Post-construction conversion to tidal habitat suitable for foraging special-status birds</td><td>B</td><td>None required</td></tr>
<tr><td>3.4-17</td><td>Short-term, construction-related injury or mortality and loss of roosting and foraging habitat for western red bats</td><td>LTSM</td><td>Mitigation Measure 3.4-17.1
This mitigation measure includes the following:
1. Confine clearing of vegetation to only those areas necessary to facilitate construction activities and no greater.
2. A pre-construction survey shall be conducted by a qualified biologist to identify roosting western red bats during the maternity season (May through August). If roosting bats are present, construction activities that involve the removal of mature riparian trees, snags, and remnant structures suitable for roosting shall be timed to avoid bat maternity season (May through August).
3. Where ever feasible the Project design and implementation would avoid potential roosting habitat especially large mature trees like cottonwood and sycamore.
4. Coordinate with CDFW on measures to minimize impacts to individuals

Mitigation Measure 3.4-3.1
(described above in Wetland and Terrestrial Biological Resources)</td></tr>
<tr><td>3.4-18</td><td>Long-term removal of western red bat roosting and foraging habitat</td><td>LTSM</td><td>Mitigation Measure 3.4-3.1 and 3.4-17.1
(described above in Wetland and Terrestrial Biological Resources)</td></tr>
<tr><td colspan="4">GEOLOGY AND SOILS</td></tr>
<tr><td>3.5-1</td><td>Long-term effect on exposure of people and structures to seismic- and landslide-related hazards</td><td>B</td><td>None required</td></tr>
<tr><td>3.5-2</td><td>Long-term effect on sediment deposition and erosion in the vicinity of Prospect Island</td><td>B</td><td>None required</td></tr>
</table>

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
		HAZARDS AND HAZARDOUS MATERIALS	
3.6-1	Potential effects from abandoned gas wells	LTSM	**Mitigation Measure 3.6-1.1** Final construction plans shall be revised to avoid existing conflicts between grading and excavation areas and well locations. Once site dewatering is complete and prior to construction work, a geophysical survey shall be conducted to confirm locations of all known abandoned gas wells, which shall be marked and avoided during construction (DOGGR 2014). Also prior to construction, DWR shall file an application under the DOGGR Well Review Program and the site would be inspected.
3.6-2	Potential effects from contaminant migration via existing groundwater monitoring wells	LTSM	**Mitigation Measure 3.6-2.1** The Project design shall incorporate the groundwater monitoring well locations into the grading and access plans and design any construction at those locations to avoid adversely affecting the wells. Wells shall be avoided or capped and/or replaced as required by Section 13750 through 13755 (Article 2, Chapter 7, Division 7) of the California Water Code.
3.6-3	Potential mobilization of contaminants from levee breaching and/or sediment dredging and re-use	LTSM	**Mitigation Measure 3.6-3.1** If soil testing identifies materials as designated or hazardous, then these materials must be removed from the Project site and properly disposed of at a permitted off-site facility. If this mitigation is triggered, additional analysis related to off-site transport and disposal of hazardous sediments may be required for other resources (e.g., air quality GHGs, traffic, noise).
3.6-4	Hazards associated with the Prospect Island houses on the north property	B	None required
3.6-5	Potential hazards associated with the abandoned house on the south property	B	None required
3.6-6	Potential soil or water contamination from onsite equipment storage and fueling	LTSM	**Mitigation Measure 3.6-6.1** DWR's standard construction contract Section 01570 requires contractors to conduct fueling and lubrication of equipment in a manner that affords maximum protection against spills and evaporation. Consistent with this standard, the contractor for the Proposed Project shall be required to prepare an environmental protection plan, which shall include spill control and contaminant prevention components. The contractor shall be required to have a spill kits on site and to clean up any spill as soon as reasonably possible.

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.6-7	Potential effects on human health due to the short-term use of aquatic-approved herbicides prior to site construction	LTSM	**Mitigation Measure 3.6-7.1** Herbicides shall be applied under the supervision of a certified pesticide applicator. Certified pesticide applicators are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, effects to human health. Prior to herbicide application, all permits shall be in place, including USACE 404, RWQCB 401, the CDFW, Streambed Alteration Agreement, Agricultural Commission and the RWQCB NPDES permit, and/or any other relevant permits required by the federal, state, and local agencies.
3.6-8	Potential effects on human health due to changes in the extent of mosquito breeding habitat	B	None required
AIR QUALITY			
3.7-1	Generation of criteria pollutant emissions that contribute to air quality violations	SU	**Mitigation Measure 3.7-1.1** The Project contractors shall implement the techniques listed in Table 3.7-8 to reduce impacts of ozone precursors such as NO_x and ROG, and PM_{10} and $PM_{2.5}$ emissions. **Mitigation Measure 3.7-1.2** Section 6.1 of the YSAQMD CEQA handbook presents a list of feasible mitigation measures to control fugitive dust from construction sites. Common strategies in controlling dust (PM_{10}) focus on minimizing dispersal of earth materials during excavation, transport, and disposal activities. Watering and covering (e.g., tarps, surfactants, and vegetation) are frequently relied on to minimize dust at construction sites. The Proposed Project contractors shall implement the techniques listed in Table 3.7-9 for controlling dust. The implementation details of these techniques shall be adjusted based on field conditions.
3.7-2	Conflict with or obstruct applicable general plans or regional air quality plans	SU	**Mitigation Measure 3.7-1.1 and 3.7-1.2** *(described above in Air Quality)*
3.7-3	Expose sensitive receptors to air pollutants and cause higher health risks	LTS	None required
3.7-4	Expose sensitive receptors to objectionable odors	LTS	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
			GREENHOUSE GASSES
3.8-1	Proposed Project-related GHG emissions	LTS	None required
			MINERAL RESOURCES
3.9-1	Loss of a known mineral resource that would be of value to the region and residents of the state	NI	None required
3.9-2	Loss of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	NI	None required
			NOISE
3.10-1	Potential for short-term noise disturbance to nearby residents	LTSM	**Mitigation Measure 3.10-1.1** The following mitigation measure would reduce the noise impact to residences in the Project area to a less-than-significant level: 1. The construction contractor shall locate stationary noise sources as far from existing residences as possible. 2. The DWR shall identify a disturbance coordinator, and the name and phone number of this person shall be conspicuously posted at the Project site in an area that can be accessed by the general public. If noise complaints are received, the disturbance coordinator shall respond to the complaints and shall take the steps necessary to mitigate the problem.
3.10-2	Potential for long-term increases in ambient noise levels in the Proposed Project vicinity	LTS	None required
3.10-3	Potential for sensitive receptors to be exposed to excessive ground-borne vibrations during construction-related activities	NI	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
AESTHETICS			
3.11-1	Temporary change in views during construction	LTS	None required
3.11-2	Long-term change in views from State Route 84	LTS	None required
3.11-3	Long-term change in views from Arrowhead Harbor Marina	LTS	None required
3.11-4	Long-term change in views from boats in Miner Slough	LTS	None required
3.11-5	Long-term change in views from boats in the Deep Water Ship Channel	LTS	None required
3.11-6	Long-term change in views from nearby residences	LTS	None required
3.11-7	Long-term light and glare	NI	None required
AGRICULTURAL RESOURCES			
3.12-1	Loss or conversion of prime, unique, or important agricultural lands	LTS	None required
3.12-2	Conflicts with Williamson Act contracted lands	NI	None required
3.12-3	Potential effects to agricultural uses on adjacent lands	LTS	None required

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
			CULTURAL RESOURCES
3.13-1	Impacts to historical resources on land	NI	None required
3.13-2	Inadvertent discovery of a shipwreck during in-water construction	LTSM	**Mitigation Measure 3.13-2.1** The title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC (PRC Section 6313[a]). In the case of an inadvertent discovery of a submerged shipwreck or related artifacts, all work must cease in the immediate vicinity of the find and DWR cultural resources staff and the USACE archaeologist shall be notified immediately in order to initiate consultation with the CSLC staff within 2 business days of such discovery pursuant to 36 CFR 800.13 (b)(3). PRC 6313 (c) states any submerged historic resource remaining in state waters for more than 50 years shall be presumed to be archaeologically or historically significant. If the DWR and USACE archaeologist, in consultation with the CSLC staff, determine that a historical resource may be present within the Project site, DWR shall retain the services of a qualified maritime archaeological consultant. The maritime archaeological consultant would recommend whether the discovery is an historical/archaeological resource that retains sufficient integrity and is of potential historical or scientific significance. The maritime archaeological consultant also would recommend as to what action, if any, is warranted, and would document all recommendations in writing. Based on this information, the USACE, in consultation with the CSLC, may require additional measures to be implemented by DWR. Measures might include preservation *in situ* of the historical resource or a data recovery program. The Project maritime archaeological consultant shall submit a Final Historical Resources Report to DWR, the USACE, and the CSLC staff. This report shall include an evaluation of the historical significance, with a description of the archaeological and historical research methods employed in any archaeological data recovery program undertaken.

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.13-3	Impacts to unknown archaeological resources	LTSM	**Mitigation Measure 3.13-3.1** The following mitigation measure shall be implemented before the start of ground-disturbing activities. 1. A DWR archaeologist shall conduct cultural resources awareness training for contractors and staff prior to the start of construction. 2. If historical or unique archaeological resources are discovered during construction, work must be halted within 100 ft of the find until a qualified archaeologist meeting the Secretary of the Interior's Standards for archaeologists (NPS 1997) visits the site and assess the significance of the resource. Work may continue on other parts of the Project while evaluation and mitigation takes place (CEQA Guidelines Section 15064.5 [f]). After the assessment is completed, the archaeologist shall submit a report describing the significance of the discovery with treatment recommendations. If the find is determined to be an historical or unique archaeological resource, time allotment and funding sufficient to allow for implementation of avoidance measures or appropriate mitigation must be available. 3. Should unique archaeological resources be found, the resources shall be treated in compliance with Public Resources Code Section 21083.2. If the Project can be modified to accommodate avoidance, preservation of the resource is the preferred alternative. Data recovery of the damaged portion of the resource also shall be performed pursuant to PRC Section 21083.2(d).
3.13-4	Impacts to unknown human burials	LTSM	**Mitigation Measure 3.13-4.1** If human remains are found, such remains are subject to the provisions of California Health and Safety Code (HSC) Section 7050.5-7055. The requirements and procedures shall be implemented, including immediately stopping work in the vicinity of the find and notification of the Solano County Coroner. The process for notification of the California NAHC and consultation with the individual(s) identified by the NAHC as the "most likely descendant" is set forth in Section 5097.98 of the California Public Resources Code. Work can restart after the remains have been investigated and appropriate recommendations have been made for the treatment and disposition of the remains.
3.13-5	Impacts to paleontological resources	NI	None required
LAND USE AND PLANNING/POPULATION AND HOUSING			
3.14-1	Potential conflicts with adjacent land uses	LTSM	**Mitigation Measure 3.17-2.1** *(described below in Transportation and Traffic)*

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.14-2	Potential conflict with plans and policies	NI	None required
3.14-3	Population and housing effects	NI	None required
PUBLIC SERVICES			
3.15-1	Potential conflict with existing police and fire protection services	LTSM	**Mitigation Measures 3.17-1.1 and 3.17-2.1** *(described below in Transportation and Traffic)*
RECREATION			
3.16-1	Short-term construction-related impacts to recreational boating in Miner Slough and Arrowhead Harbor Marina	LTSM	**Mitigation Measure 3.16-1.1** Speed limit zones or channel closure shall be established by DWR during in-water construction along Miner Slough. The Project construction contractor shall post and distribute notifications at Arrowhead Harbor Marina and other local boating access sites of any scheduled imposition of boating safety speed limits or channel closure 14–30 days in advance of water-based construction work.
3.16-2	Long-term impacts to recreational boating in Miner Slough and Arrowhead Harbor Marina	LTS	None required
3.16-3	Long-term Impacts on recreational use of Prospect Island	NI	None required
3.16-4	Consistency with existing plans	LTS	None required
TRANSPORTATION AND TRAFFIC			
3.17-1	Potential traffic impacts during construction	LTSM	**Mitigation Measure 3.17-1.1** The construction contractor shall submit a traffic control plan to DWR for review and approval that shall limit impacts to adjacent land owners and buisnesses. The control plan shall include temporary measures, such as the following: • Advance public notification signage at the Project site prior to the start of construction activities, to alert drivers to pending construction work and traffic restrictions. • Temporary railing, barricades, crash cushions, signage, lighting and flashing lights, pavement markings, and the service of qualified flaggers; all as required to provide for the safe passage of public traffic through or around the work zones. • Other safety measures as required to control vehicular and pedestrian traffic through the work zones.

Impact No.	Impact Title	Significance	Proposed Mitigation Measures
3.17-2	Potential long-term loss of access to Miner Slough levee	LTSM	**Mitigation Measure 3.17-2.1** DWR shall mitigate the loss of access by providing alternative access to the cut-off portion of this levee or by reaching an access settlement through property or easement purchase. Alternative access options must include physical access for affected residents and emergency vehicles. If alternative access is provided, then additional analysis related to potential impacts on other resources may be required (e.g., water quality, terrestrial biological resources, air quality GHGs, traffic, noise, aesthetics).
UTILITIES			
3.18-1	Solid waste disposal impacts	LTS	None required
3.18-2	Potential for adverse effects on existing utilities	LTSM	**Mitigation Measure 3.18-2.1** Prior to any ground disturbing activities DWR and its contractors shall perform the following: 1. Coordinate with local utility owners to discuss the potential for the existence of underground utilities within the Proposed Project area. 2. If utility owners verify the potential for underground utilities, a qualified person shall perform a subsurface survey to identify the exact location of underground utilities within the Proposed Project area, so those utilities may be avoided. If the utilities cannot be avoided, they shall be removed in a manner consistent with CalOSHA Title 8 Sections 1539 through 1541.1.
3.18-3	Potential for adverse effects to easement holders	LTS	None required

Significant Unavoidable Adverse Impacts

With the exception of short-term impacts to perennial aquatic habitats and wetland communities due to site dewatering for construction, and generation of pollutant (i.e., NOx) emissions that would contribute to air quality violations and conflict with regional air quality plans, there would be no significant unavoidable adverse impacts due to the Proposed Project or alternatives.

Alternatives to the Proposed Project

Two “build” alternatives and the No Project Alternative were selected to be analyzed in this EIR based on a rigorous alternatives screening and selection process (refer to Section 4 Alternatives). These alternatives vary in the location and type of breaching of the levees, as well as inclusion (or not) of the south property. For all of the alternatives, the U.S. Army Corps (USACE) would continue to maintain the DWSC levee as a Navigation Project Levee.

Alternative 1 represents the No Project Alternative to be evaluated under CEQA. Under this alternative, current management practices would continue.

Alternative 2 would include two breaches in the Miner Slough levee; one in the central portion of Prospect Island, just north of the existing internal cross levee, and the second would be constructed at the location of the formerly repaired breach connecting the Miner Slough spur channel to the south property. In addition, a high stage overflow weir would be constructed near the entrance to Arrowhead Marina near the overflow weir in the far northeast corner of the island. A portion of the internal cross levee separating the north and south properties would also be removed under this alternative. Once breached, the north and south properties would be subject to daily tidal inundation, with periodic overtopping of the weir at high tide during spring tide conditions.

Under Alternative 3, three breaches would be created on the Miner Slough levee: two in the north property, the first approximately 0.5 miles south of Arrowhead Harbor Marina, the second in the central portion of the Miner Slough levee. On the south property, the third breach would be constructed at the location of the formerly repaired breach connecting to the Miner Slough spur channel to the south property.Under this alternative, the internal cross levee separating the north and the south properties would remain intact, and the levee road and portions of the Miner Slough levee south of the central breach would be maintained. DWR would protect the cross levee from potential impacts by raising, reinforcing, and/or widening the half-mile cross levee on Prospect Island. Because the north and south properties would not be hydraulically connected, except via tidal exhanges with Miner Slough, no dredging of the Miner Slough spur channel would be required under Alternative 3. Once the Miner Slough levee is breached, the north and south properties would be subject to daily tidal inundation.

CEQA requires that the EIR identify an environmentally superior alternative other than the No Project Alternative. Alternatives 2 and 3 are both environmentally superior compared with the Proposed Project because neither would require dredging of the Miner Slough spur channel, resulting in reduced short-term construction-related impacts to water quality and aquatic species in Miner Slough. However, Alternative 2 is slightly more beneficial than Alternative 3 due to the replacement of the northern Miner Slough breach, which requires full excavation of the levee during construction, with a weir, which requires only partial excavation. The weir would result in slightly lower export of primary productivity to surrounding Delta waterways as compared to a breach in this location under the Proposed Project and Alternative 3; this would be a reduced benefit. However, the weir would also result in lower potential export of water quality consitituents of concern (e.g., DOC, methylmercury), to adjacent waterways relative to the Proposed Project and Alternative 3. Although Alternative 2 would result in the greatest potential impact to valley/foothill riparian habitat, increased amounts of freshwater tidal emergent marsh would be relatively more beneficial to wetland-associated species (e.g., giant garter snakes, western pond turtles, special-status and migratory birds, and western red bats) than the other alternatives. Lastly, under Alternative 2, access to a privately owned parcel on the northern portion of Prospect Island bordering Miner Slough would be available via the road across the Miner Slough levee weir, except during flood conditions.

Coordination with Public and Other Agencies

Coordination with federal, state, and local agencies would be required for approvals and the issuance of permits for construction of the Proposed Project. A list of the identified responsible agencies, permit or approval types, and their status is presented in Table ES-2.

Table ES-2. List of the Identified Responsible Agencies, Permit or Approval Types, and Their Status

Agency	Permit or Approval Type	Status
U.S. Army Corps of Engineers (USACE), Sacramento District	CWA Section 404/RHA Section 10 Permit	Draft application submitted on 9/24/2014 (SPK-2013-00085)
Central Valley Regional Water Quality Control Board (CVRWQCB)	• CWA Section 401 WQC • PCWQCA WDR • CWA Section 303(d) Delta MeHg TMDL Control Study • CWA Section 402 Permit Registration Documents	In Progress
Central Valley Flood Protection Board (CVFPB)	Title 23 CCR Division 1 Encroachment Permit	In Progress
California Department of Fish and Wildlife (CDFW)	• FGC Section 1602 Lake or Streambed Alteration Agreement • CESA Section 2081 Incidental Take Permit	In Progress
U.S. Fish and Wildlife Service (USFWS)	ESA Sec 7 Biological Opinion	In Progress
National Marine Fisheries Service (NMFS)	• ESA Sec 7 Biological Opinion • MSA EFH Conservation Recommendations	In Progress
Delta Stewardship Council (DSC)	Consistency Determination	In Progress
California State Lands Commission (CSLC)	State Lands Lease Amendment	In Progress
State Historic Preservation Officer (SHPO)	NHPA Section 106 Consultation	In Progress
U.S. Coast Guard	Local Notice to Mariners for work in navigable waterways	In Progress

Issues to be Resolved

Issues to be resolved related to the Proposed Project include the following:

- Long-term maintenance of access between Prospect Island and a privately owned parcel adjacent to Miner Slough in the central part of the north property;
- Removal of PG&E power distribution infrastructure on the north property; and
- Obtaining environmental regulatory permits in a timely fashion to begin construction in spring 2018.

Areas of Controversy

Based on agency and stakeholder input, including responses to the NOP, potential areas of controversy are listed below and relevant Draft EIR sections that discuss those concerns follow in the parentheses. As indicated elsewhere in the Draft EIR, these potential areas of controversy were determined to be unfounded or would result in either no impact or be less than significant, based on substantial evidence.

- Potential groundwater seepage impacts from Prospect Island to adjacent areas (Section 3.1 Hydrology);
- Potential impacts to water rights for downstream water users from diversion of surface water (Section 3.1 Hydrology).

1 INTRODUCTION

1.1 Overview of the Project

The Project is an approximately 1,600-acre (ac) tidal restoration project in southeastern Solano County proposed by the DWR. Prospect Island is located immediately east of, and technically is still an element of, the southern end of the Yolo Bypass. Prospect Island became separated from the Bypass with construction of the DWSC in the 1960s. The site is bounded on the east by Miner Slough, on the west by the DWSC, on the south by the confluence of the DWSC and Miner Slough, and on the north by an east-west levee that runs from Arrowhead Harbor Marina to the DWSC. DWR is the CEQA Lead Agency for this Project. Both the northern, 1,300-ac portion and the southern, 300-ac portion of Prospect Island are owned by DWR.

The Project would include a suite of actions necessary for site preparation, restoration, minimizing or avoiding potential adverse impacts, post-restoration monitoring, and maintenance. Some activities are incorporated in the Proposed Project description, while others may be incorporated into the Project and/or alternatives depending on results of the EIR analyses. These elements are listed below and described in detail in Section 2 Project Description.

The Proposed Project would include:

1. Pre-construction site preparation, including repairing the leak in the south property levee, dewatering, clearing, constructing access roads and ramps, and preparing staging areas, for the purpose of implementing all of the actions listed below.
2. Invasive plant species control, for the purpose of reducing the potential for ecological or other invasive species impairments within the restoration site and surrounding areas.
3. Debris removal, to reduce non-native fish predator habitat on the restored site.
4. Excavation of tidal slough channels, for the purpose of facilitating internal tidal circulation and external connectivity.
5. Placement of excavated soils into selected remnant agricultural ditches, for the purpose of promoting target tidal circulation and tidal channel formation.
6. Placement of excavated soils into the site interior, for the purpose of creating internal topographic features and thus ecological variability.

7. Placement of excavated soils to construct a gently sloped eastern toe berm on the interior side of the eastern levee, for the purpose of improving levee erosion protection.
8. Placement of excavated soils to construct an eastern intertidal bench in areas interior to the Miner Slough levee and adjacent to subtidal areas, for the purpose of improving levee erosion protection.
9. Removal of a portion of the internal cross levee, for the purpose of connecting the north and south properties hydrologically and promoting tidal circulation and external connectivity.
10. Excavation of two levee breaches to Miner Slough, for the purpose of restoring tidal connectivity.
11. Placement of excavated soils into the site interior at levee breach locations, for the purpose of reducing velocity gradients at levee breaches.
12. Dredging of the spur channel between Miner Slough and the south property and placement of dredged material within Prospect Island (if it meets sediment quality standards), for the purpose of providing unimpeded tidal exchange.

Under the Proposed Project, the Miner Slough levee would be breached in two locations: one in the north property approximately 0.5 miles south of Arrowhead Harbor Marina and one in the south property at the location of the formerly repaired breach connecting to the Miner Slough spur channel. A portion of the internal cross levee separating the north and the south properties would also be removed. Once these breaches were completed, the north and south portions of the site would be subject to daily tidal inundation.

Two “build” alternatives and the No Project Alternative were selected to be analyzed in this EIR based on a rigorous alternatives screening and selection process (refer to Section 4 Alternatives). These alternatives vary in the location and type of breaching of the levees, as well as inclusion (or not) of the south Property.

1.2 Project Objectives

The Project is intended to partially fulfill the 8,000-ac tidal habitat restoration obligations of DWR contained within Reasonable and Prudent Alternative (RPA) of the U.S. Fish and Wildlife Service (USFWS) Delta Smelt Biological Opinion (BiOp) for long-term coordinated operations of the State Water Project (SWP) and the federal Central Valley Project (CVP) (USFWS 2008). Because restoration of tidal habitat would provide access for salmonid rearing at Prospect Island, the Project would also be consistent with RPA I.6.1 of the National Marine Fisheries Service (NMFS) Salmonid BiOp for SWP/CVP operations (NMFS 2009a).

The overarching goal of the Project is to restore tidal action to the interior of Prospect Island.

The six Project objectives are to:

1. Enhance primary and secondary productivity and food availability for Delta Smelt and other native fishes within Prospect Island and surrounding Delta waterways.
2. Increase the quantity and quality of salmonid rearing habitat within and in the areas surrounding Prospect Island.
3. Increase the amount and quality of habitats to support other listed species, to the extent they can be supported by site conditions and natural processes.
4. Provide other ecosystem benefits associated with increased Delta freshwater tidal marsh habitat, including water quality enhancement, recreation, and carbon sequestration.
5. To the greatest extent practical, promote habitat resiliency to changes in future Delta conditions, such as land use conversions, climate change, sea level rise, and invasive species.
6. Avoid promoting conditions adverse to Project biological objectives, such as those that would favor establishment or spread of invasive exotic species.

1.3 Project Background and History

Historically, the Project area was tidal marshland, with Prospect Slough to the west and north, and Miner Slough to the east and south. Levees were constructed during the later 19th century and the land was converted to agricultural uses. Prospect Island is part of the Yolo Bypass floodplain; however construction of the DWSC in the 1960s isolated Prospect Island from the main reach of the Yolo Bypass.

The 1,300-ac northern portion of Prospect Island was purchased by the U.S. Bureau of Reclamation (USBR) in 1994 to be part of a proposed North Delta National Wildlife Refuge. Agriculture on the island ceased, but efforts to establish a refuge were not successful. Without near-term implementation of a restoration project that had been planned by the U.S. Army Corps of Engineers (USACE) and DWR, USBR initiated the process to transfer or sell the island to another entity. DWR acquired the northern portion of Prospect Island from USBR in January 2010.

The DWR land is mostly inundated. The southern portion of Prospect Island is subject to limited tidal exchange through a levee breach that was repaired with very large rock (about 3- to 5-feet [ft] diameter), and remains permeable but not navigable. The internal cross levee that separates the two parcels is intact.

1.4 Public Involvement and Environmental Issues Raised

During the Project-planning phase, a Notice of Preparation (NOP) was prepared and processed to indicate that an EIR would be prepared for the Proposed Project (in compliance with CCR Section 15082 of the *State CEQA Guidelines*). The NOP was distributed for a 30-day public review period that included distribution to agencies, the public and affected stakeholders, beginning on May 17, 2013 (refer to Appendix B).

The availability of the NOP was publicized locally (*Sacramento Bee*) and distributed to a wide array of government agencies both directly by DWR and through the Governor’s Office of Planning and Research, State Clearinghouse. It was also posted with the County of Solano Recorder’s Office. The NOP distribution list and written responses are included in Appendix A.

A public scoping meeting was held for the Proposed Project on June 10, 2013, in West Sacramento. A Scoping Report summarizing the scoping process and comments received is included in Appendix B.

Information was gathered via the NOP, public meetings, outreach, and coordination with many agencies and interested parties, as well as other affected stakeholders and adjacent property owners that submitted comments in response to the NOP. Because of this ongoing collaborative effort with regulatory agencies and input from the public, aspects of the Project (e.g., tidal channel configuration and levee breach locations) have been modified since the release of the NOP.

Major issues identified in scoping included:

- Project description should address all phases of the Project, equipment to be used, access roads, staging areas, construction procedures, construction schedule, and long-term monitoring of mitigated lands and biological resources.
- The EIR should include a cumulative impacts section to determine all past, present, and probable future projects in the area that may contribute to a greater level of environmental impacts.
- In order to avoid the improper deferral of mitigation, mitigation measures should either be presented as specific, feasible, or enforceable obligations, or should be presented as formulas containing “performance standards”.
- Concern about visual effects of vegetation removal along the road on Prospect Island.
- The effect of global warming and associated potential rise in sea levels along the California coast and associated effects on local hydrology, water quality, and perimeter levee stability, including effects on local facilities and infrastructure.
- A greenhouse gas emission (GHG) analysis consistent with the California Global Warming Solutions Act should be developed. If impacts are significant, the commentor asked that mitigation measures that would reduce the impacts to the extent feasible be identified in the EIR.
- DWR should work closely with California Department of Fish and Wildlife (CDFW), USFWS, and NMFS during development of the EIR to identify any special-status plants or wildlife species occurring in the Project area that may be affected by the Project. Cumulative impacts should be considered.
- If new habitat for endangered species is created, nearby Ryer Island reclamation district (RD 501) operations could be negatively impacted.
- The geologic and hydrologic structure of Prospect Island should be analyzed to identify potential linkages with surrounding areas (such as sand lenses shared with Ryer Island), and consider the effects that permanent flooding of Prospect Island would have based on any linkages identified
- The potential for bass to enter the restoration area should be studied.
- DWR should verify that the stated objectives in the NOP are consistent with Delta Plan Policies ER R2 and EP P5.
- Project-level activities related to habitat restoration and management should be done in coordination with local and regional Habitat Conservation Plans, and DWR should coordinate with Caltrans in instances where DWR

and Caltrans programs share stewardship responsibilities for habitats, species, and/or migration routes.

- The EIR should consider the Project's potential to encourage the establishment or proliferation of aquatic invasive species such as the quagga mussel, or other nonindigenous, invasive species including aquatic and terrestrial plants.
- The EIR should include a complete assessment of the habitats, flora and fauna within and adjacent to the Project area, including endangered, threatened, and locally unique species and sensitive habitats.
- Because the Project's intent is to create rearing habitat for endangered or threatened species, the EIR should consider the potential for additional safeguards to reduce the risk of harm from intake pumps used to divert surface water for irrigation on adjacent islands.
- Concern about beavers in the Project area.

1.5 Purpose and Uses of the EIR

DWR is the CEQA Lead Agency and has the principal responsibility for carrying out or approving the Prospect Island Restoration Project. As lead agency, DWR has primary responsibility for CEQA compliance when preparing the EIR (Public Resource Code [PRC] Section 21067).

In accordance with CEQA (Public Resources Code [PRC] Section 21000 *et seq.*), and the *State CEQA Guidelines* (California Code of Regulations [CCR] Section 15000 *et seq.*), DWR would utilize the information contained in the EIR in deciding whether to approve the Proposed Project. The EIR may also be considered by other public agencies in the exercise of their statutory authority to grant permits and provide approvals. A discussion of the agencies and their discretionary actions is presented in the next section.

In accordance with CEQA and the *State CEQA Guidelines (*Section *15064 and PRC* Section *21080(d), 21082.2(d))*, this project-level EIR addresses those impacts that could be potentially significant, as identified through a collaborative process. An EIR is a detailed informational document prepared by the lead agency that analyzes a Project's potential significant effects and identifies mitigation measures and reasonable alternatives to avoid or reduce those significant effects (*State CEQA Guidelines* Section15121(a), 15362).

1.6 Agency Approvals and Permits

Pursuant to the *State CEQA Guidelines* (CCR Section 15124[d]), a number of responsible, trustee, and other affected agencies are anticipated to rely on the EIR and related documentation for discretionary actions they may take in conjunction with the Project.

Depending on the final design of the Project and the affected environmental resources involved, the responsible and trustee agencies for this Project may include, but are not limited to the following state and local agencies and entities:

- CDFW. California Fish and Game Code (FGC) Section 1602, Lake or Streambed Alteration Agreement; California Endangered Species Act (CESA) consultation and, if required, FGC Section 2081(b) Incidental Take Permit and FGC Section 2080.1 Determination; and consultation/coordination with Project elements associated with the post-construction phase, as applicable.
- California State Historic Preservation Officer (SHPO). Letter of concurrence with USACE via the National Historic Preservation Act (NHPA) (NHPA Section 106).
- Central Valley Flood Protection Board (CVFPB). CCR, Title 23 Water Code, Floodway Encroachment Permit; and consultation on related matters associated with Project implementation and within CVFPB jurisdiction.
- Central Valley Regional Water Quality Control Board (CVRWQCB). Federal Clean Water Act (CWA) Section 401 Water Quality Certification; Porter-Cologne Water Quality Control Act Waste Discharge Requirement (WDR); and CWA Section 402 National Pollution Discharge Elimination System (NPDES) General Permit for Storm-water Discharge associated with Construction and Land Disturbance Activities (Construction General Permit), as well as possibly a General NPDES Permit under CWA Section 402 for discharging biological and residual pesticides to the waters of the United States for vector control in association with post-construction activities, as needed; coordination of methylmercury (MeHg) related issues as required by the Delta Mercury Program. Additionally, consultation on related matters associated with Project implementation and within CVRWQCB jurisdiction.
- California State Lands Commission (CSLC). Approval would be required for any lands owned and/or managed by CSLC (e.g., meander bends along Miner Slough presumed to be under the ownership of CSLC, see Figure 2.1-3).

- Solano County. DWR would apply for all legally applicable local permits from Solano County.

Additionally, the EIR may be used by federal permitting agencies to support Project decisions and to inform their review under the National Environmental Policy Act (NEPA), as applicable. Federal permitting agencies with anticipated jurisdiction over the Proposed Project are listed below.

- USACE. A CWA Section 404 Permit would be required to authorize the discharge of fill material to waters of the United States. A Rivers & Harbors Section 10 permit would be required for construction activities in navigable waters (i.e., all tidally influenced waters in the legal Delta).
- U.S. Environmental Protection Agency (USEPA). USEPA has oversight responsibility for all federal CWA permits.
- National Marine Fisheries Service. NOAA Fisheries has jurisdiction over all anadromous fish species listed as threatened or endangered under the federal Endangered Species Act (ESA) to issue a BiOp on the Project. NOAA Fisheries also regulates Essential Fish Habitat (EFH) in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.
- U.S. Fish and Wildlife Service. USFWS has jurisdiction over all resident fish and terrestrial species listed as threatened or endangered under the federal ESA to issue a BiOp on the Project and a Section 7 ESA permit, if necessary. USFWS also implements the Migratory Bird Treaty Act (MBTA) and related permitting, if necessary.

Other public agencies with a non-permitting interest in the Proposed Project may include but not be limited to: U.S. Coast Guard; California Department of Conservation, Division of Land Resource Protection; California Air Resources Board; West Sacramento Area Flood Control Agency; Delta Stewardship Council; The Delta Conservancy; California Department of Transportation, District 4; California Department of Boating and Waterways; Delta Protection Commission; and Solano County Mosquito Abatement District.

Lastly, DWR could enter into leasing agreements or purchase agreements with private property owners and other entities for site access, construction, and/or the storage/placement of the excavated soils, depending on final engineering designs and the chosen soils re-use option and/or alternative.

1.7 Availability and Public Review of the EIR

This Draft EIR is being distributed to the public and affected government agencies for review and comment during a 45-day public review period (in compliance with CCR Section 15087 of the *State CEQA Guidelines*), **starting on Tuesday, August 23, 2016** and **ending on Friday, October 7, 2016.** Written comments must be received no later than 5:00 pm on **Friday, October 7, 2016** at the following address:

Department of Water Resources
Attention: Daniel Riordan
P.O. Box 942836
Sacramento, CA 94236

Comments may also be sent via e-mail to frpa@water.ca.gov.

Copies of the Draft EIR are also available at the following locations:
http://www.water.ca.gov/environmentalservices/frpa_prospect_restoration.cfm

Solano County Recorder's Office
Rio Vista Library
Walnut Grove Library
Fairfield Civic Center Library
Vacaville Public Library − Cultural Center

A Public Open House will be held on September 27, 2016, from 7−9 pm at the following address:

Suisun City Nelson Community Center
611 Village Drive
Suisun City, CA 94585

At the end of the public review period, DWR will evaluate comments on environmental issues received from the public and agencies that reviewed the Draft EIR and would prepare written responses (CCR Section 15088 of the *State CEQA Guidelines*). The comments and the responses will be added to the Final EIR.

DWR will consider, among other things, the information contained in the Final EIR as well as determine the adequacy of the environmental documentation under CEQA. In compliance with CEQA (CCR Section 15090), prior to approving the Project, DWR shall certify that (1) the Final EIR has been completed in compliance with CEQA; (2) the Final EIR was presented to the decision-making body of DWR and that the decision-making body reviewed and considered the information contained in the Final EIR prior to approving the Project; and (3) the Final EIR reflects the lead agency's independent judgment and analysis.

1.8 Report Organization

The Draft EIR is organized as follows:
Table of Contents. Location of chapters/sections, tables, figures, and technical appendices.

Acronyms and Abbreviations. List of acronyms and abbreviations used in the EIR.

Summary. Summary of Project description, impacts, mitigation measures, alternatives, and the potential areas of known controversy/issues to be resolved.

Section 1: Introduction. Purpose of the EIR, California Environmental Quality Act (CEQA) requirements, organization of Draft EIR, Scope of the EIR, and Uses of the EIR.

Section 2: Project Description. Background, previous restoration proposals and environmental reviews, Project context within Delta regional planning efforts and water operations, and Proposed Project, including location, objectives, description of Project components and construction activities, and current land uses.

Section 3: Environmental Setting, Impacts, and Mitigation Measures. Existing conditions, significance criteria, effects analyses, proposed mitigation measures, and residual impacts following application of mitigation measures. Environmental topics in the Draft EIR are:

Biophysical Resources

- Hydrology (Section 3.1)
- Water Quality (Section 3.2)
- Aquatic Biological Resources (Section 3.3)
- Wetland and Terrestrial Biological Resources (Section 3.4)
- Geology and Soils (Section 3.5)
- Hazards and Hazardous Materials (Section 3.6)
- Air Quality (Section 3.7)
- Greenhouse Gases (Section 3.8)

- Mineral Resources (Section 3.9)
- Noise (Section 3.10)

Human Resources

- Aesthetics (Section 3.11)
- Agricultural Resources (Section 3.12)
- Cultural Resources (Section 3.13)
- Land Use and Planning/Population and Housing (Section 3.14)
- Public Services (Section 3.15)
- Recreation (Section 3.16)
- Transportation and Traffic (Section 3.17)
- Utilities (Section 3.18)
- Cumulative Impacts (Section 3.19)

Section 4: Alternatives. This section presents a range of potentially feasible alternatives, including the No Project alternative, two “build” alternatives, one of which is identified as the environmentally superior alternative. Alternatives considered and rejected also are presented and discussed in this chapter.

Section 5: List of Preparers and Contributors of the Environmental Impact Report.

Section 6: References.

2 PROJECT DESCRIPTION

2.1 Proposed Project

This Proposed Project includes a series of proposed actions to restore up to 1,528 ac of diked lands to tidal wetlands. The Proposed Project location, site history, and Proposed Project context are described below.

2.1.1 Proposed Project location

Prospect Island (38°15'12.30"N, 121°39'24.90"W) is located in Solano County, in the northern Sacramento-San Joaquin River Delta (Delta) (Figure 2.1-1). It is located within Township 5 North, Range 3 East of the Liberty Island and Rio Vista, California USGS 7.5-minute topographic map.

Prospect Island is part of the Sacramento River Flood Control Project (SRFCP). It was separated from the southern end of the 59,000-ac Yolo Bypass by the DWSC, constructed by USACE in the 1960s. The entire site is enclosed by a levee system with lower (‘restricted’) heights, designed to allow overtopping in large flood events. Prospect Island has one internal cross levee that separates the north property and the south property (Figure 2.1-2).

For the purposes of the CEQA analysis, the Project site includes all areas bounded by the perimeter levees of Prospect Island as well as potential in-water work areas at planned breach locations. The Project site is bounded on the east by Miner Slough, on the west by the DWSC, on the south by the 37-ac Miner Slough Wildlife Area, managed by CDFW, and on the north by a levee that runs from Arrowhead Harbor Marina to the DWSC (Figure 2.1-2). In addition, 17.7 ac of existing agricultural land north of the northern cross levee (Table 2.2-2 and Figure 2.2-1) would be converted to a temporary staging area.

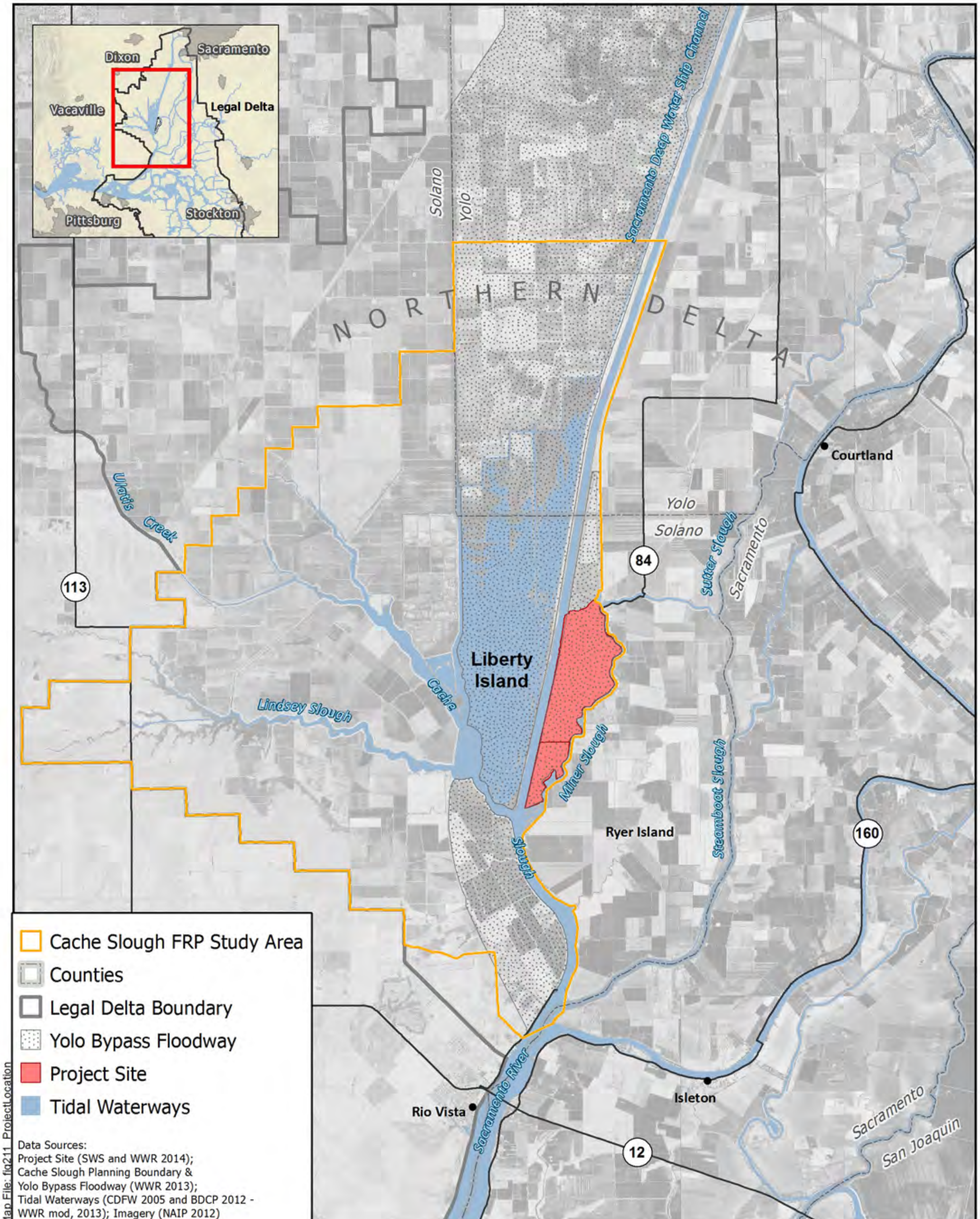

Figure 2.1-1

Project Location

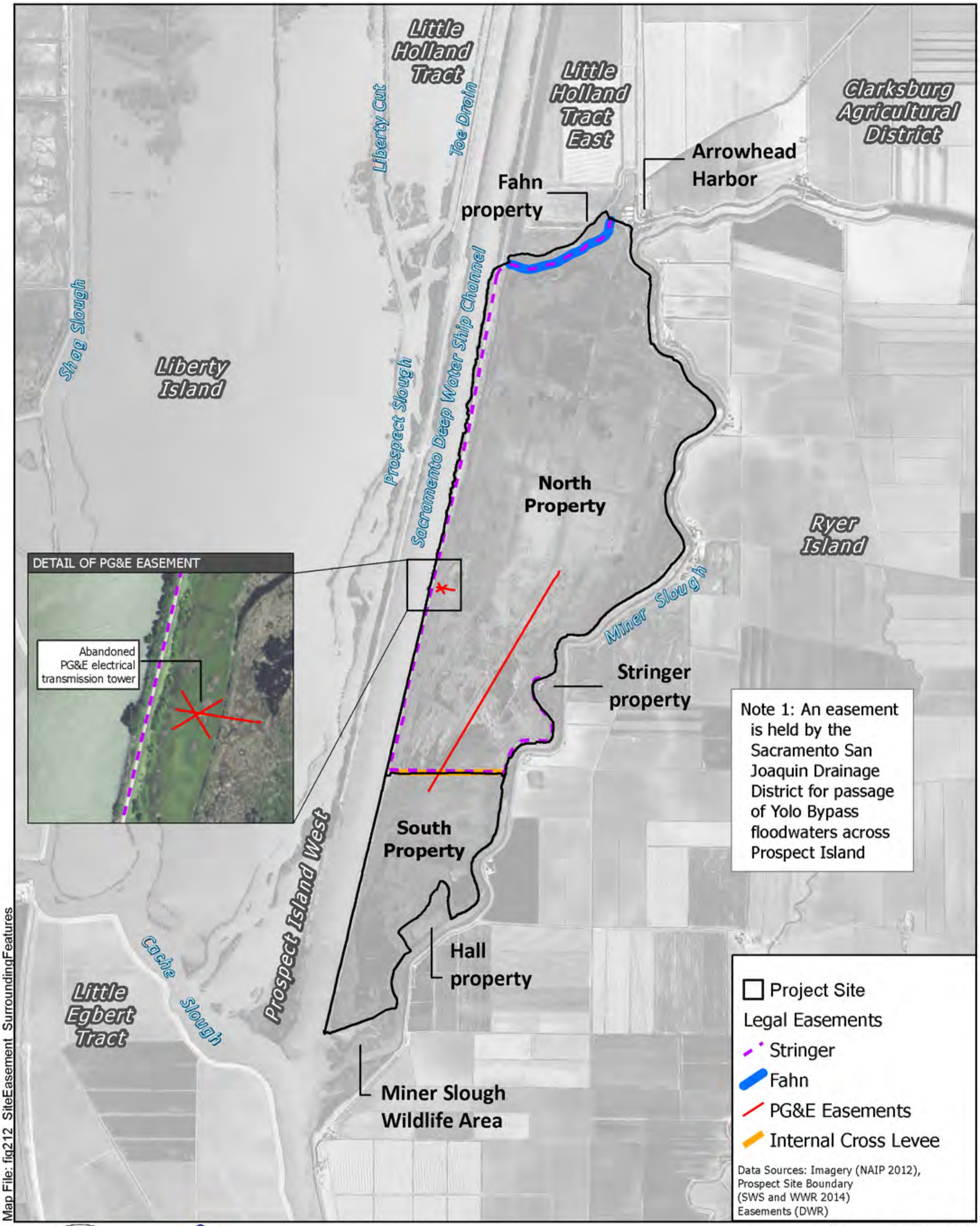

Figure 2.1-2
Prospect Island Site Easements and Surrounding Features

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

2.1.2 Site history

Levees around Prospect Island were first constructed during the late nineteenth century to create farmland. At that time, the tidal slough that formed the northern boundary of the island was diked as well, connecting Prospect Island to other reclaimed lands to the north. A cross levee was later constructed and has been maintained to keep the southern portion of Prospect Island hydrologically separated from the lands to the north. The first ownership claims of the island date to 1860.

Prospect Island was made part of the Sacramento River Flood Control Project in the early twentieth century. Like other lands at the southern end of the Yolo Bypass (Little Holland Tract, Liberty Island, Little Egbert Tract), all of the Prospect Island levees were constructed and maintained as “restricted height levees”, designed to overtop during larger floods to provide additional flood storage capacity. By design, agricultural operations on the island were subject to interruption and damage during flood events. There were levee breaches and/or flooding on Prospect Island in 1919, 1938, 1940, 1962, 1963, 1980, 1981, 1983 (twice), and 1986. Following these events, the levees were repaired and the island was pumped dry to return the land to agricultural use.

The Port of Sacramento purchased the island in the early 1950s for construction of the DWSC. All levees surrounding Prospect Island were kept at the restricted height elevations, including the western levee, which forms the eastern side of the DWSC and, with construction of the DWSC, became designated as a federal navigation levee. Placement and removal of dredge materials generated from the DWSC dredging operations occurred on the land- (internal) sides of the north, west, and internal cross levees of Prospect Island, ranging in width from 200 ft along the cross levee and western levee area, to a variable width along the northern levee segment.

The south property was also used as a receiving site for dredge material during construction. The south property has not been used for dredged material placement since construction of the DWSC, and may have been farmed between 1963 and 1986, although crop records are not available. The south property has been leased out for duck hunting for a number of years. DWR obtained ownership of the south property in June 2015.

After the DWSC was constructed in 1963, the north property was sold by the Port to the Sakata Brothers, and Reclamation District (RD) 1667 was activated to maintain the north property as farmland. Wheat, corn, and safflower were grown on the site until 1994 (USACE and DWR 2001). The Sakata Brothers maintained ownership until the U.S. Bureau of Reclamation (USBR) acquired the site in 1995 as part of a multi-agency effort to restore wetland and riparian habitats in the Delta (DWR 2012a). Prospect Island, along with two other parcels purchased using public funds (Liberty Island and Little Holland Tract), were to be part of a proposed North Delta National Wildlife Refuge and were to be managed by the USFWS. However, the refuge was never established.

Prospect Island has a significant history of flooding, with 13 reported flood events since 1919 (Hopf 2011). Shortly after the USBR acquired the property, in March 1995, flooding caused two levee breaches at the site, one in the Miner Slough levee on the south property and a second at the internal cross levee separating the south property from the north property. The levee breaches were repaired and the north property was pumped dry in July 1996; however, the site was again flooded in 1997 before farming could resume. Levee repairs were completed in 1999; farming activities were not resumed following these repairs (USACE and DWR 2001). The levees breached again in 2006, including a failure of the internal cross levee. These repeated levee failures were eventually repaired (at great expense), but lands remained flooded for extended periods following each breaching event before the island was again pumped dry.

Following the early 2008 repair of the 2006 levee breach, flood water was pumped off of the north property. Sometime after the site was dewatered, the flap gate on the small drainage culvert on Miner Slough was damaged and pumping was discontinued, allowing inundation and very limited but regular water exchange between Prospect Island and Miner Slough.

DWR acquired the northern portion of Prospect Island from USBR in April 2010 and reactivated the Prospect Island Reclamation District (RD 1667) in January 2014 to facilitate land management activities.

2.1.3 Current land use and ownership

The Project site (including both the north property and south property) is currently flooded, uncultivated land. The interior of the south property is largely shallow aquatic habitat with portions invaded by aquatic weeds and fringed by emergent marsh and riparian vegetation. The south property is currently leased out for year-round waterfowl hunting.

Ownership is shown in Figure 2.1-3. DWR owns most of the lands comprising the northern portion of Prospect Island, north of the internal cross levee. Along Miner

Slough within the north property is a small piece of land with no assigned County Assessor's parcel number. This land appears to be an old meander bend from the time before Miner Slough was straightened and is therefore unknown ownership, although it is presumed to be under the ownership of the CSLC. DWR also owns most of the lands south of the internal cross levee.

The adjacent DWSC allows cargo vessels to access the Port of West Sacramento. Recreational vessels use the DWSC and Miner Slough, including the two small side channels, for fishing and recreational boating.

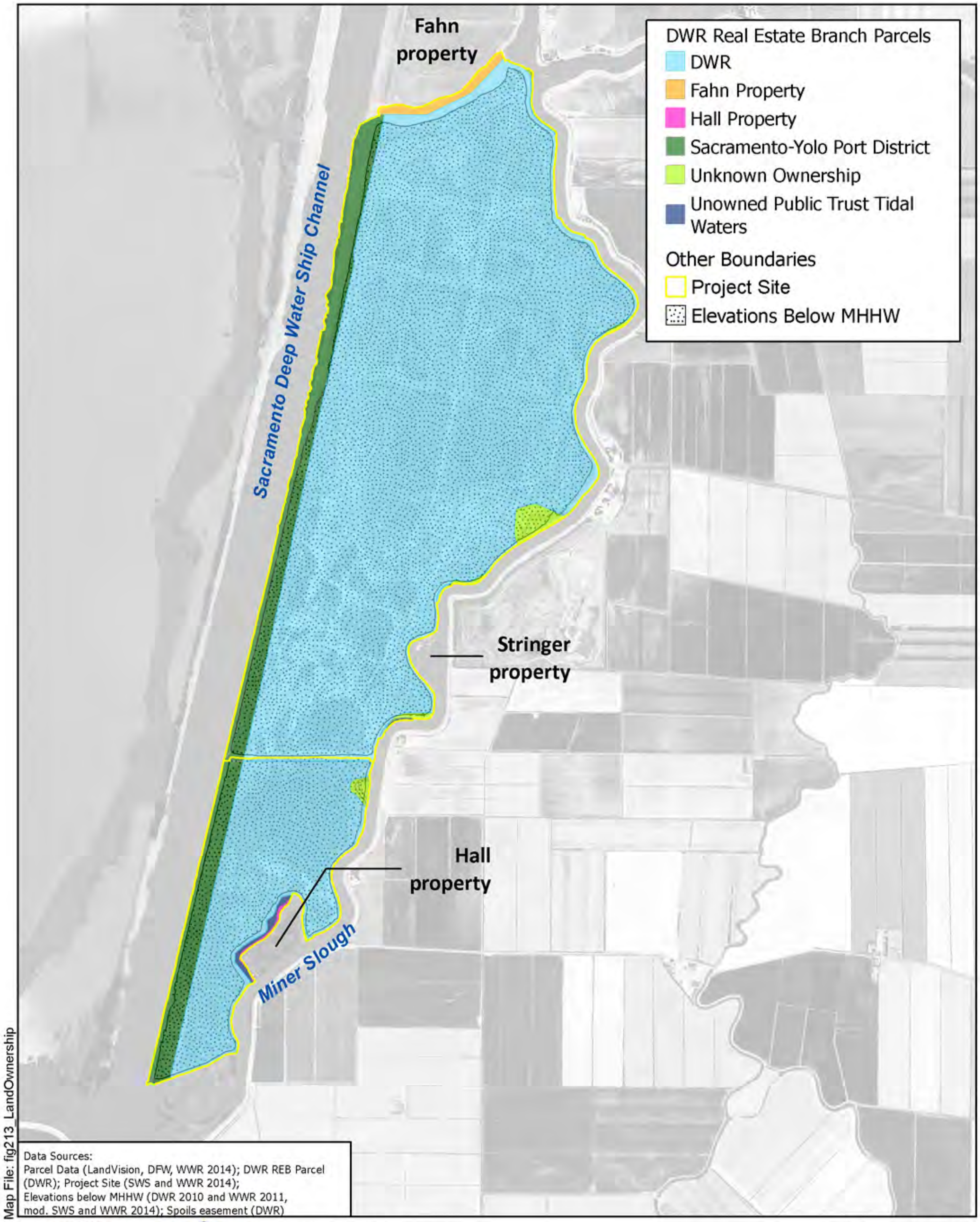

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Figure 2.1-3
Land Ownership at Prospect Island

2.1.4 Surrounding properties

Prospect Island is flanked by the DWSC to the west and Miner Slough to the east (Figure 2.1-2). On the western side of the DWSC lies the flooded Liberty Island, and to the east, across Miner Slough, is Ryer Island. The Fahn property and Arrowhead Harbor Marina are located just north of Prospect Island.

There are three small additional properties adjacent or connected to Prospect Island. These include the Miner Slough Wildlife Area to the south, Hall Island along the Miner Slough side of the south property, and a privately owned parcel adjacent to Miner Slough in the central part of the north property (Figure 2.1-2). Additional information on the ownership and land use of the surrounding properties is provided below.

Miner Slough Wildlife Area

Located adjacent to the south end of Prospect Island is the Miner Slough Wildlife Area. Managed by CDFW, the Miner Slough Wildlife Area is a 37-ac tidal and riparian reserve. With only 10 ac above the high tide water elevation, the Miner Slough Wildlife Area is composed of one small island and a narrow peninsula extending from Prospect Island. The Miner Slough Wildlife Area provides boat-accessible recreation opportunities, and supports a variety of fish and wildlife species, including beaver, black-crowned night heron, and other waterfowl.

Ryer Island

To the east across Miner Slough is Ryer Island. With the exceptions of the Snug Harbor Resort residential area on the southeastern portion of the island, a marina on the southern tip, and a Wetland Reserve Program managed wetland near Miner Slough; the vast majority of Ryer Island is actively farmed.

Hall Island

Hall Island is a privately owned island bordered by Prospect Island and Miner Slough. The 21-ac property was once connected by a road to Prospect Island and supported multiple residences. The property flooded sometime between 1993 and 2002 and has remained inundated since. Currently, the only infrastructure remaining is a small, decrepit boat dock and associated development on the southern tip. There is currently no land access between Hall Island and the Prospect Island levees (Figure 2.1-2).

Fahn property

The Fahn property is actively farmed agricultural land just north of Prospect Island. The 457-ac property is a remnant of Little Holland Tract, which was bisected by construction of the DWSC.

Arrowhead Harbor Marina

Arrowhead Harbor Marina is located just north of Prospect Island across Miner Slough, at the southwestern tip of the Clarksburg Agricultural District. This small 5-ac marina is the closest marina to the Project site, and the only one currently operational on Miner Slough.

Stringer property

A small, 9-ac privately owned parcel of land is connected to the central part of the north property bordering Miner Slough. Most of the small parcel is inundated. There is a dilapidated house that has been unoccupied located on the northern portion of the parcel. Currently access to this parcel is on a gated road along Miner Slough. However, legal access to the parcel is via roadways atop the north levee and DWSC levees, then across the interior cross levee and up Miner Slough levee (Figure 2.1-2).

2.1.5 Proposed Project context within Delta regional restoration efforts

Prospect Island is located at a unique landscape position in the northern Delta. The Project site sits between the Cache Slough Complex (CSC) to the west at the downstream end of the Yolo Bypass, and the Sacramento River to the east via its distributary channel, Miner Slough (Figure 2.1-4). The CSC is a 53,000-ac region in the northern Delta composed of extensive diked lands mostly in agricultural use; two large and four small flooded islands that now contain tidal marsh and shallow tidal open waters; tidal sloughs, many of which support tidal marsh and riparian margins and in-channel islands; and the southern end of the Yolo Bypass.

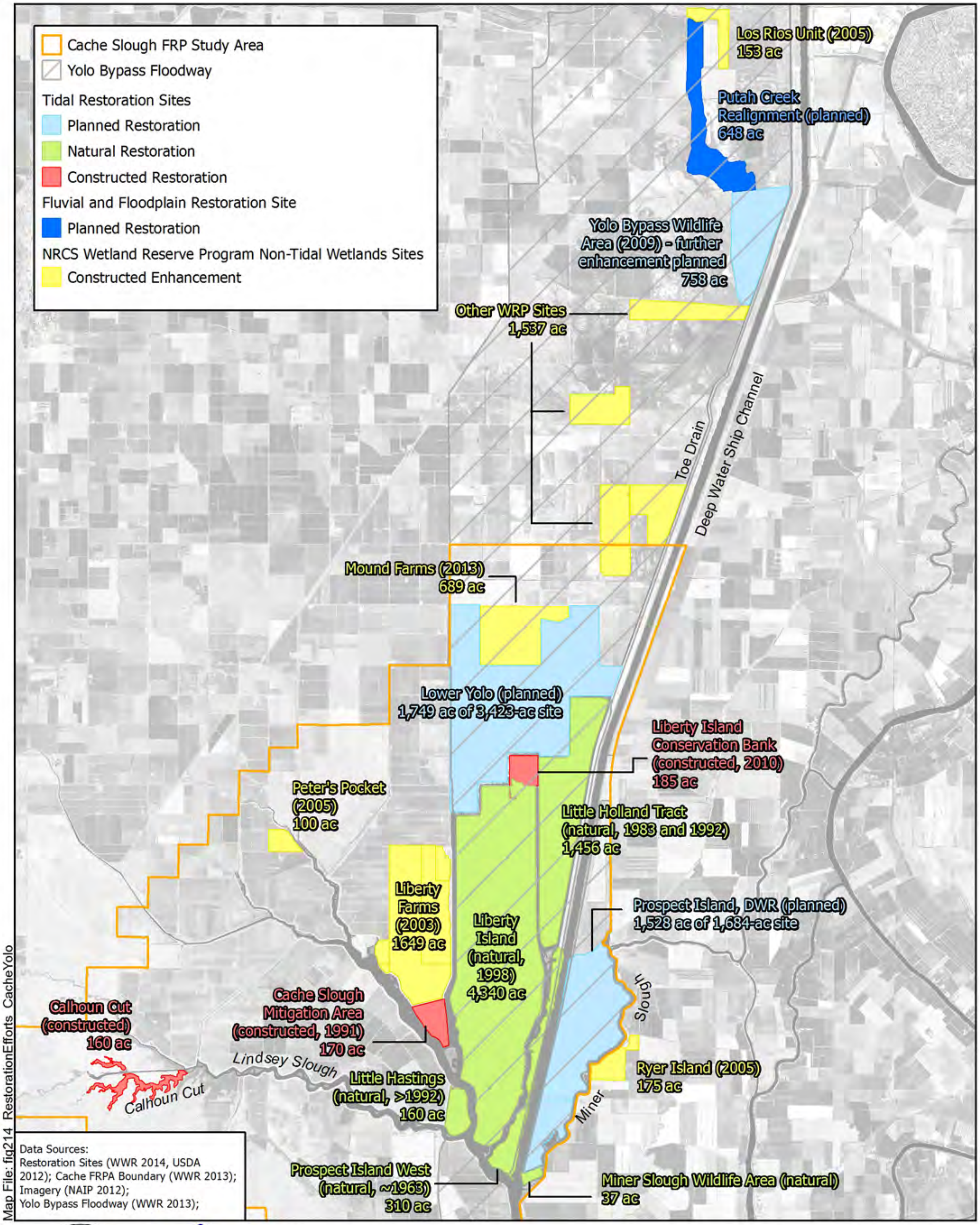

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Figure 2.1-4
Restoration Efforts in the Cache - Yolo Region

Turbidity levels in portions of the CSC are often the highest observed in the Delta, providing important habitat benefits to native fishes (Morgan-King and Schoellhamer 2013). The CSC has been identified as important spawning and rearing grounds for migratory Delta Smelt, in addition to supporting a year-round non-migratory population of Delta Smelt (Sommer and Mejia 2013). This is thought to be due to a combination of factors, including locally high turbidity, abundance of productive tidal marsh and shallow tidal aquatic habitats, connectivity to the Yolo Bypass, and the hydrodynamic influence of the large, shallow flooded islands creating a wide range of hydraulic residence times (the duration of time that a particle of water in the water column stays in one area) in various parts of the CSC.

Miner Slough connects the Sacramento River to the habitats in the CSC, and is a migration corridor for Sacramento River adult and juvenile Chinook salmon populations (Perry and Skalski 2009, Perry et al. 2013). Tidal restoration along this corridor would offer directly accessible habitats for migratory salmonids. The net downstream flow in Miner Slough creates a local setting where tidal influence diminishes rapidly over a short distance, reflecting the transition from the tidal Delta to the riverine Sacramento River. This hydrodynamic setting affords opportunities for variable aquatic residence times and tidal mixing with reconnection of Prospect Island.

The landscape position and identified ecological functions of the CSC, in combination with its sparse urban development and infrastructure, relatively intact hydrologic connections to tidal influence, and little land subsidence as compared with the central Delta, have made the region a focus for ecosystem restoration since the early development of the CALFED Bay-Delta Program (CALFED) Ecosystem Restoration Program (ERP) in the 1990s. Regional and local restoration efforts are described in greater detail in Section 3.19 Cumulative Impacts.

2.2 Proposed Project Actions

2.2.1 Summary

The Proposed Project would consist of a suite of actions necessary for site preparation, restoration, minimizing or avoiding potential adverse impacts, post-restoration monitoring, and maintenance. Some activities are incorporated in the Proposed Project description, while others may be incorporated into the Proposed Project and/or alternatives depending on results of the EIR analyses.

Elements of the Proposed Project include:

1. Pre-construction site preparation, including repairing the leak in the south property levee, dewatering, clearing, constructing access roads and ramps, and preparing staging areas, for the purpose of implementing all of the actions listed below.
2. Invasive species control, for the purpose of reducing the potential for ecological or other invasive species impairments within the restoration site and surrounding areas.
3. Old infrastructure and debris removal, which, in subtidal areas, would reduce non-native fish predator habitat on the restored site.
4. Excavation of tidal slough channels, for the purpose of facilitating internal tidal circulation and external connectivity.
5. Placement of excavated soils into selected remnant agricultural ditches, for the purpose of promoting target tidal circulation and tidal channel formation.
6. Placement of excavated soils into the site interior, for the purpose of creating internal topographic features and thus ecological variability.
7. Placement of excavated soils to construct a gently sloped eastern toe berm on the interior side of the eastern levee, for the purpose of improving levee erosion protection.
8. Placement of excavated soils to construct an eastern intertidal bench in areas interior to the Miner Slough levee and adjacent to subtidal areas, for the purpose of improving levee erosion protection.
9. Removal of a portion of the internal cross levee, for the purpose of connecting the north and south properties hydrologically, and promoting tidal circulation and external connectivity.
10. Excavation of two levee breaches to Miner Slough, for the purpose of restoring tidal connectivity.
11. Placement of excavated soils into the site interior at levee breach locations, for the purpose of reducing velocity gradients at levee breaches.
12. Dredging of the spur channel between Miner Slough and the south property and placement of dredged material within Prospect Island for the purpose of providing unimpeded tidal exchange.

Prior to implementation of the above listed actions, soils to be excavated for potential re-use on-site would be tested to determine engineering and geotechnical properties as well as the presence of potential contaminants. For the purposes of this EIR, we assume that the physical and chemical soil properties would be suitable for construction of the interior topographic features, eastern toe berm, and eastern intertidal bench. The approximate slopes and elevations of the constructed features summarized in Table 2.2-1, and described sequentially below, would be finalized during detailed design on the basis of planned soil testing.

Table 2.2-1. Restoration Activities and Features of the Proposed Project and Alternatives

Restoration Activities and Proposed Project Features	Proposed Project Activities and Components
South property levee repairs	Install sheet pile repair or rock and soil fill at 2:1 slopes Rock armor placed above low permeability geotextile
Site dewatering	Install temporary dewatering pumps (locations TBD)
Invasive plant species control	Upland and wetland/upland species: apply mechanical and/or herbicide methods Aquatic species: application of aquatic-approved herbicide and/or physical removal with clearing (above)
Pre-construction clearing	Within moderate subtidal areas, clear all vegetation, dead trees, and snags. Within intertidal areas, clear all vegetation, dead trees and snags within 100-ft buffer around excavated channel network, breaches, eastern toe berm, eastern intertidal bench, and access roads/ramps. Avoid removal of dead trees and snags from areas within the intertidal zone that do not impede construction. Roll down all intertidal vegetation in areas outside of the 100-ft buffer. To the extent practicable, retain large (living) trees in place at eastern toe berm and bench locations. Retain cleared snags for potential re-use as raptor perches and turtle basking sites where possible.
Access roads & ramps	Build ramps from levees down into site interior at grades suitable for construction equipment Re-use access road materials on site (e.g., for re-surfacing levee roads) (locations TBD)
Staging areas	Prepare temporary staging location in existing agricultural land owned by DWR, between the northern cross levee and the adjacent Fahn property Prepare temporary staging location in subtidal area To the extent practicable, avoid areas supporting riparian trees > 4 inches in diameter at breast height (dbh)
Old infrastructure removal	Fill or remove existing Miner Slough culvert Remove dilapidated pump house, remains of bunkhouse, and any other remains of outbuildings on the north property, and remove collapsed house on south property Remove or relocate existing pump stations on the north property (following site dewatering) PG&E to remove abandoned power lines, tower, and poles

Restoration Activities and Proposed Project Features	Proposed Project Activities and Components
Interior channel network excavation (dimensions are approximate)	Excavate tidal channels in areas above -1 ft NAVD88 Channel invert elevation: -3 to -4 ft NAVD88 Channel invert width: 45 to 90 ft Side slopes: 2.5:1
Block or fill remnant agricultural ditches	Use excavated soils to block or fill remnant agricultural ditches not incorporated into constructed channel network
Construct interior topographic features	Create small patches of higher intertidal habitat within the site with materials excavated from channel network Max elevation ~ MHW to MHHW (6-6.5 ft NAVD88)
Construct eastern toe berm	Construct non-structural berm along portions of the interior toe of the Miner Slough levee Upland areas revegetated with native riparian species
Construct eastern intertidal bench	Construct non-structural bench to intertidal elevations along the central portion of the interior of the Miner Slough levee Construct from fill generated by channel network excavation If needed, plant with tules in areas subject to wind wave erosion, but no more than 20’ in width Limited experimental planting
Excavate internal cross levee (dimensions are approximate)	Invert elevation: -4 ft NAVD88 Invert width: 395 ft Side slopes: 2.5:1 Use excavated soils to block/fill borrow ditch that runs along north side of the internal cross levee
Construct breach velocity dissipation	Place fill excavated from construction of the channel network and from upland portions of levee breaches onto the interior sides of the levee at one of the two breach locations
Dredge Miner Slough spur channel	Dredge spur channel between Miner Slough and south property breach to accommodate volume of tidal exchange between Miner Slough and the restored Project site Dewater and beneficially re-use dredge material in south property

Restoration Activities and Proposed Project Features	Proposed Project Activities and Components	
Breach Miner Slough levee (dimensions are approximate)	<u>Northern Miner Slough</u> Invert elevation: -4.6 ft NAVD88 Breach invert width: 531 ft Side slopes: 2:1	<u>Southern Miner Slough</u> Invert elevation: -4.0 ft NAVD88 Breach invert width: 394 ft Side slopes: 2:1

2.2.2 Anticipated future habitat conditions, Proposed Project

This section describes the future habitat conditions anticipated following completion of the above-described site preparation and construction activities for the Proposed Project. Changes in Natural Community habitat types from existing conditions are shown in Figure 2.2-1 and Table 2.2-2.

As-built conditions

Upon completion of construction and breaching of the Miner Slough levee, the interior of Prospect Island would be reconnected with tidal exchange from Miner Slough. The resulting habitats would be primarily tidal perennial aquatic (open water) habitat with tidal mudflat habitat exposed at intertidal elevations (Figure 2.2-1 and Table 2.2-2). The retained natural communities would initially be limited to emergent wetland vegetation remaining within intertidal habitats as well as valley/foothill riparian habitats located along the DWSC levee, northern cross levee, and the upper slopes of the Miner Slough levee.

Future conditions

Valley/foothill riparian and tidal freshwater emergent wetland habitats on the restored Prospect Island site are anticipated to colonize and expand from the as-built condition (Figure 2.2-1). As emergent marsh vegetation establishes over time, open water habitat is expected to decrease from the as-built condition, with a corresponding increase in tidal freshwater emergent wetland habitat at intertidal and shallow subtidal elevations (Table 2.2-2). Although future estimates of developed lands (i.e., roads) are shown to be the same as existing conditions, roads and grassland habitat along the portions of the Miner Slough and internal cross levee that are not maintained would revert to valley/foothill riparian habitat in the future.

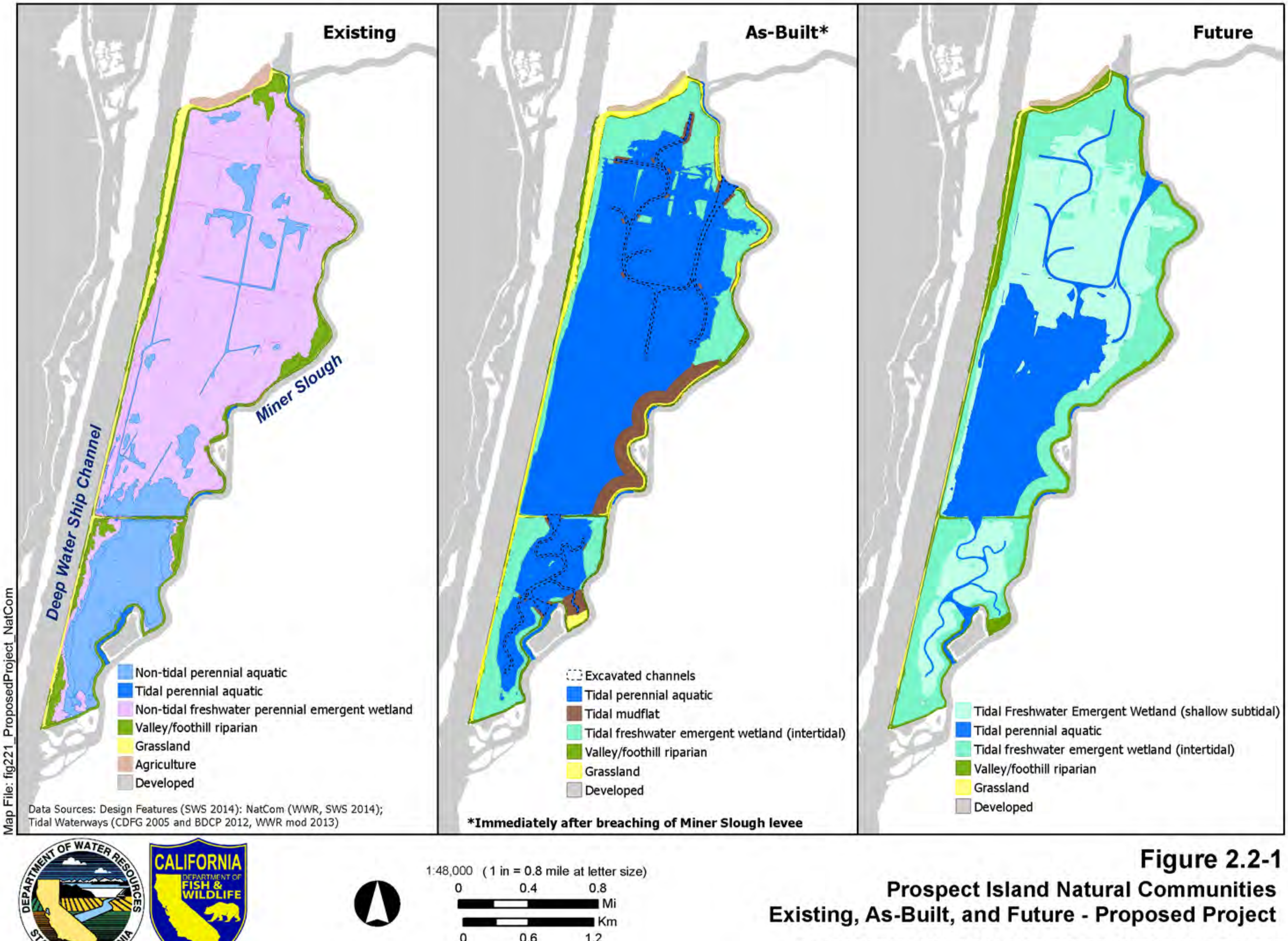

Figure 2.2-1
Prospect Island Natural Communities
Existing, As-Built, and Future - Proposed Project

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

It is anticipated that emergent vegetation would colonize intertidal elevations within approximately the first three years post restoration and expand laterally into the shallow subtidal elevations within approximately 10–15 years following breaching. Figure 2.2-1 shows estimated maximum future tidal emergent marsh extent corresponding to establishment at intertidal (2.1–6.5 ft NAVD88) as well as shallow subtidal elevations (0.1–2.1 ft NAVD88). Based upon observations in the Delta and known submergence tolerances of emergent marsh species, tidal freshwater emergent marsh habitat is expected to establish in the intertidal zone down to -2 ft Mean Lower Low Water (MLLW). Simenstad et al. (2000) surveyed six wetlands historically flooded islands and four reference wetlands and found the lower edge of emergent vegetation generally ranged between +0.7 ft to -2.0 ft MLLW, with a median of -1.0 ft. Furthermore, observations in natural tidal marshes as well as recent observations at nearby Liberty Island (Simenstad et al. 2000, Orr et al. 2003, Hester et al. 2013), marsh emergent vegetation may slowly colonize shallow subtidal habitats (approx. 1–2 ft below MLLW) over the long term via lateral growth (approx. 1–3 ft/year) from plants that establish in the adjacent low intertidal zone. However, there is currently uncertainty over the magnitude and rate at which such subtidal emergent vegetation can develop following restoration in the Delta (Hester et al. 2013), especially given the projected trajectory of mean sea level rise over the next several decades.

Table 2.2-2. Prospect Island Natural Communities: Existing, As-Built, and Future—Proposed Project

Acres by Natural Community Type[1]			Existing	As-Built[2]	Future	Change in Area
Aquatic	Non-tidal	Non-tidal perennial aquatic	339.8	0.0	0.0	-339.8
	Tidal	Tidal perennial aquatic[4]	10.3	1,088.7	472.4	462.0
Wetlands	Non-tidal	Non-tidal freshwater perennial emergent wetland	1,100.5	0.0	0.0	-1,100.5
	Tidal	Tidal mudflat (graded areas of eastern intertidal bench and toe berm)	0.0	87.7	0.0	0.0
		Tidal freshwater emergent wetland (intertidal)	0.0	347.7	437.3	437.3
		Tidal freshwater emergent wetland (shallow subtidal)	0.0	0.0	615.4	615.4
Uplands		Valley/foothill riparian	145.2	53.5	117.5	-27.7
		Grassland	66.4	91.5	26.5	-39.9
		Agriculture	17.7	10.9	10.9	-6.8
Other		Developed	4.5	4.5	4.5	0.0
Aquatic	Non-tidal		339.8	0.0	0.0	-339.8
	Tidal		10.3	1,088.7	472.4	462.0
					Subtotal aquatic	**+122.1**
Wetlands	Non-tidal		1,100.5	0.0	0.0	-1,100.5
	Tidal		0.0	435.4	1,052.7	1,052.7
					Subtotal wetlands	**-47.8**
Aquatic and Wetlands	Non-tidal		1,440.3	0.0	0.0	-1,440.3
	Tidal		10.3	1,524.1	1,525.1	1,514.8
					Subtotal perennial aquatic and wetlands	**+74.4**
Uplands			229.3	155.9	154.9	-74.4

1 Acreages within Project site boundary are based on Natural Communities Data (ESA, SWS 2014). Summations may vary due to rounding.
2 As-built acres are immediately after breaching of Miner Slough levee.
3 Change calculated as future minus existing area estimates of natural community types.
4 Although portions of the south property interior was designated as tidal Waters of the U.S. in the Preliminary Wetland Delineation (DWR 2014b), there is no fish passage through the degraded breach repair and other habitat functions are similar to those in nontidal perennial aquatic habitats.

2.2.3 Description of Proposed Project components and construction activities

The Proposed Project consists of a suite of actions to prepare the site for restoration, construct restoration features, and restore tidal action to the site. This section summarizes the levee breach configurations and major restoration actions of the Proposed Project. It presents an overview of general restoration activities and features in greater detail, and it presents material quantities and dimensions for the Proposed Project.

The Proposed Project would start with pre-construction site preparation, to be followed by site modifications internal to the island, and would end with levee breaching to allow tidal inundation of the Project site. Figure 2.2-2 depicts a general design schematic for the Proposed Project, Figure 2.2-3 illustrates site preparation elements and Figure 2.2-4 illustrates clearing and grubbing areas. Table 2.2-3 provides estimated material quantities and dimensions for the restoration activities and features of the Proposed Project.

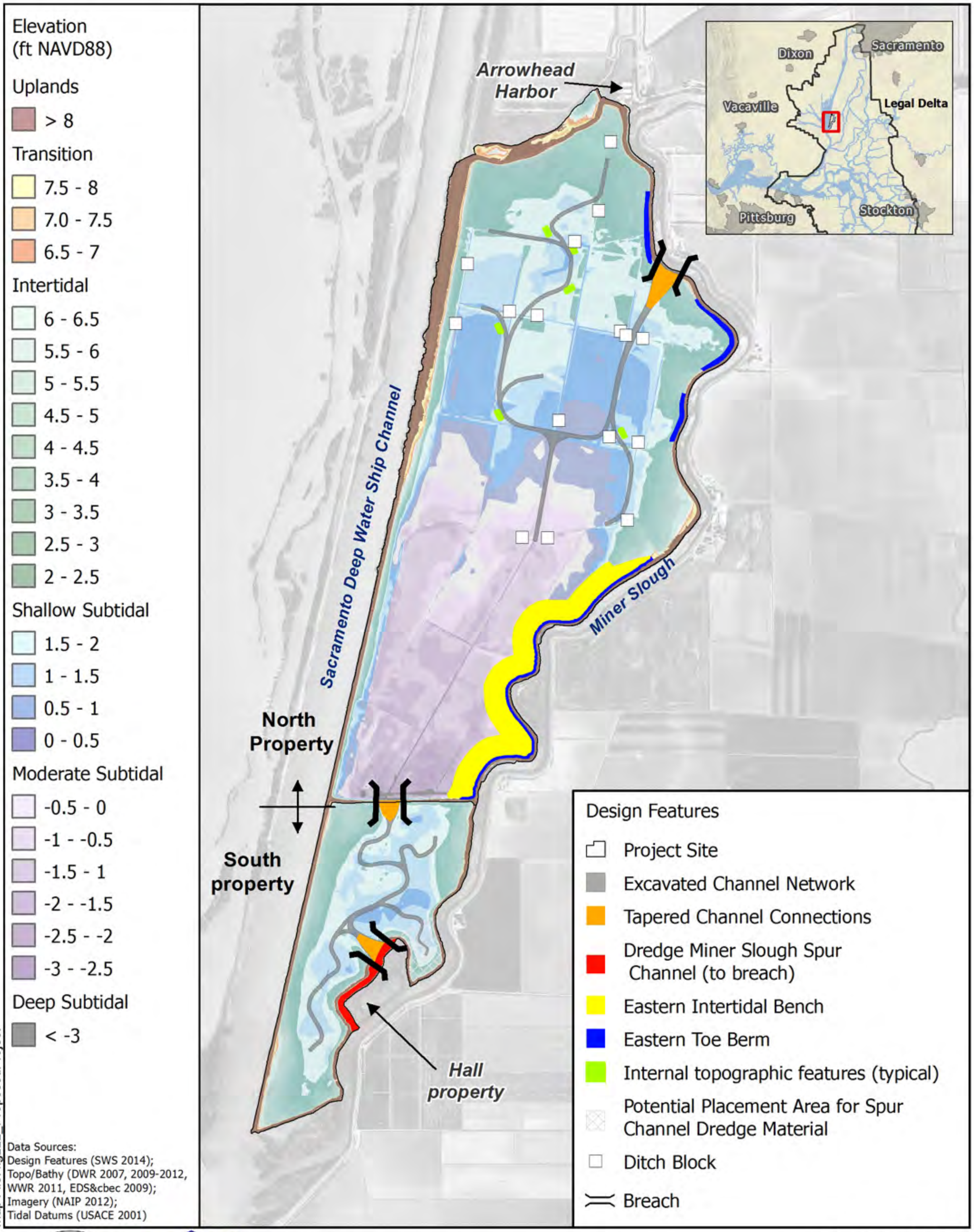

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Figure 2.2-2
Proposed Project

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

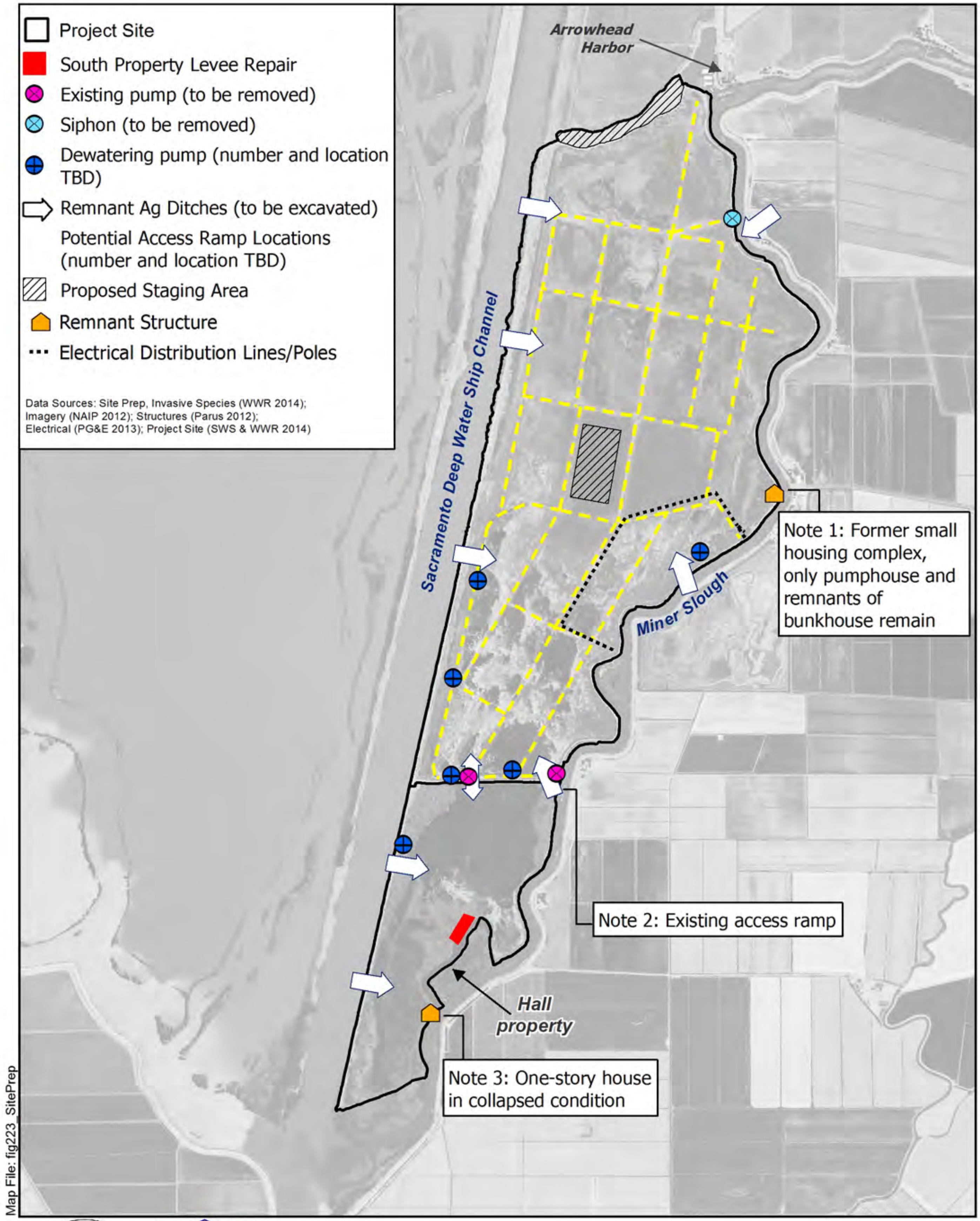

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Figure 2.2-3
Site Preparation

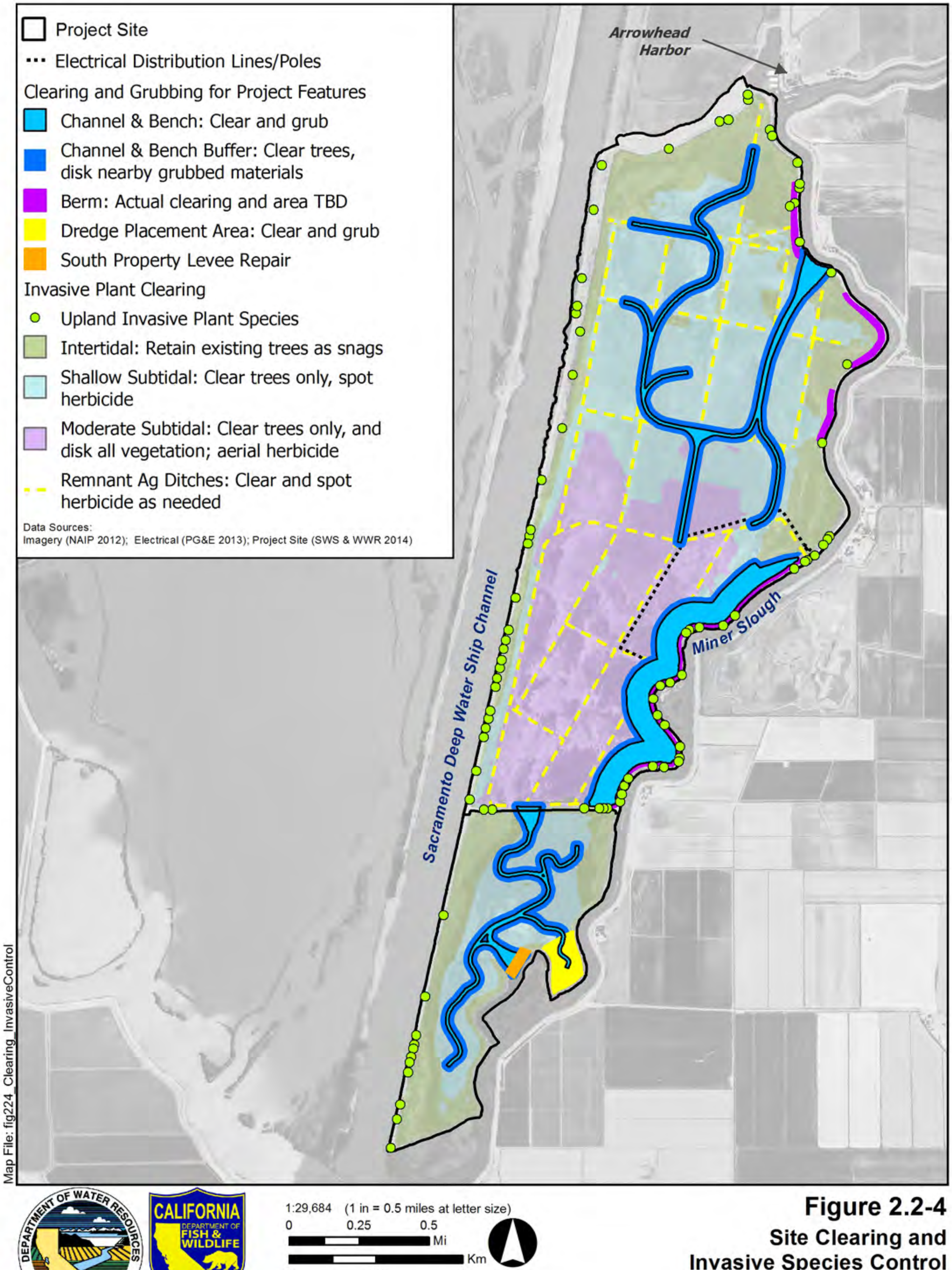


Figure 2.2-4
Site Clearing and Invasive Species Control

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Table 2.2-3. Estimated Material Quantities and Dimensions

No.	Restoration Activities and Project Features	Units	Quantities
1	South property levee repair		
	Fill placement	cubic yards	3,000
	Sheet piles	feet	200
	Geotextile	sq ft	10,000
	Stone armoring	tons[1]	200
2	Pre-construction site preparation		
2a	Dewatering and water management		
2a1	Clear existing agricultural ditches		
	Area	acres	62
	Debris to be chipped/disked on-site	cubic yards	3,400
2a2	Plug existing culvert in Miner Slough levee	cubic yards	22
2a3	Install temporary pump	# pumps	6
	Fill placement	cubic yards	1,560
	Sheet piles	feet	660
	Excavate Sumps	cubic yards	(500)
2b	Clearing		
2b1	Clearing and Grubbing (channel network, toe berm, intertidal bench, access roads/ramps, dredge placement area)		
	Area	acres	156
	Volume of debris to be disked on-site	cubic yards	7,300
2b2	Clearing and disking within 100 ft buffer of construction footprint and all areas <0 ft NAVD 88 (moderate subtidal)		
	Area	acres	504
	Volume of debris to be disked in place	cubic yards	18,500
2b3	Tree clearing within all areas from 0.0 to 2.1 ft NAVD 88 (shallow subtidal).		
	Area	acres	496
	Volume of debris to be disked on-site	cubic yards	<10
2c	Roads and ramps		
	Ramps		
	Locations	each	12
	Length	feet	1,390
	Area	acres	1
	Volume of fill	cubic yards	7,500
	Aggregate Base	cubic yards	500
	Roads (contingency volume if site cannot be dewatered to fully support equipment)		
	Area	acres	16
	Volume of fill	cubic yards	39,000

No.	Restoration Activities and Project Features	Units	Quantities
	Aggregate Base	cubic yards	3,500
2d	Temporary staging area (adjacent to north levee)	acres	17.7
	Temporary staging area (interior)	acres	25
	Aggregate Base	cubic yards	30,000
3	Pre-restoration invasive plant species control		
3a	Aquatic (aerial spraying of agricultural ditches and moderate subtidal habitats < 0 ft NAVD 88)		
	Area	acres	411
	Application rate	pounds	2,900
3b	Upland (backpack spot treatment)		
	Area	acres	6.4
	Application rate	pounds	97
4	Debris and old infrastructure removal		
	Remove existing pumps	each	2
	Demolish/remove abandoned structures	each	2
	Total volume of debris (hauled to landfill)	cubic yards	(100)
5	Excavate constructed channel network		
	Area	acres	59.4
5a	Excavation Volume (calculated)		
5a1	Tapered connections to channel network	cubic yards	(61,000)
5a2	Channel network	cubic yards	(335,200)
6	Block or fill remnant agricultural ditches		
	Length	feet	6,000
	Area	acres	2
	Volume of fill (estimated)	cubic yards	17,000
7	Construct interior topographic features		
	Quantity	# mounds	6
	Area	acres	3
	Fill Volume	cubic yards	27,000
8	Construct eastern toe berm		
	Area	acres	18.5
	Fill Volume	cubic yards	139,000
9	Construct eastern intertidal bench		
	Area	acres	66.5
	Fill Volume	cubic yards	340,000
10	Excavate internal cross levee		
10a	Excavate breach		
	Invert Width	feet	400
	Area	acres	2
	Excavation Volume	cubic yards	(20,000)

No.	Restoration Activities and Project Features	Units	Quantities
10b	Fill borrow ditch		
	Area	acres	3
	Fill Volume	cubic yards	4,000
11	Construct breach velocity dissipation feature		
	Area	acres	1
	Fill Volume	cubic yards	7,000
12	Dredge Miner Slough spur channel		
12a	Dredging		
	Area	acres	5
	Volume	cubic yards	(47,000)
12b	Dredged Materials Placement Area		
	Containment Area	acres	12
	Fill Volume	cubic yards	6,600
13	Planting and revegetation		
13a	Wetland planting		
	Eastern toe berm (maximum potential area shown, not all will be planted)	acres	14
	Eastern intertidal bench (experimental planting)	acres	5
13b	Riparian planting Eastern toe berm (upper elevations) and other upland areas (staging area, DWSC levee interior)	acres	80
14	Remove Access Roads and Ramps		
	Area	acres	1
	Excavation Volume	cubic yards	(34,000)
15	Breach Miner Slough levee		
	Total Top Width	feet	1,060
	Area	acres	3
	Rock slope protection	tons[1]	250
15a	Excavation volume (above MHHW)	cubic yards	(47,300)
15b	Excavation volume (below MHHW)	cubic yards	(3,500)

1 Conversion to tons based on bulk density of 1.4 tons/cubic yard

Construction activities for the Proposed Project

1. South property levee repair

The purpose of repairing the south property Miner Slough levee would be to facilitate dewatering of the south property as needed during Proposed Project construction. This activity would involve restoration of proper function to the levee where a previous breach was repaired (and is currently leaking) at the end of the Miner Slough spur channel (Figure 2.2-3).

The temporary repair would be accomplished using soil and rock fill or by installing a sheet pile cut-off wall. A layer of low-permeability geotextile may be placed above the earth fill, and armored with stone at a 2:1 slope to protect against erosion from the new levee crest down to the base of the slope, below the water. Construction materials and equipment may be transported by barge and/or truck, and may potentially access the repair site along the Miner Slough levee.

2. Pre-construction site preparation

The purpose of pre-construction site preparation activities would be to ready the site for equipment operations and access during Proposed Project construction, including removal of snags and other debris, and to facilitate invasive plant species control activities. Figure 2.2-3 illustrates the general locations of these activities to the extent they are currently defined.

Pre-construction site preparation activities would include the following:

a. **Dewatering and water management, for the purpose of creating suitable conditions for Proposed Project construction**

   Under existing conditions, both the north and the south properties are inundated. Dewatering of surface waters in the north property would rely on clearing of the existing agricultural drainage ditch network with temporary pumps installed at low points within the Project site. All or portions of the existing remnant agricultural drainage network would be rehabilitated and used as needed, through a combination of deepening, widening, and/or vegetation and sediment removal. The existing culvert and flap gate structure connecting the north property to Miner Slough would be plugged in place using concrete. The existing (non-operating) pump stations would be demolished with temporary diesel-powered pumps installed at other locations.

   Platforms and drainage sumps for all temporary pumps would be constructed using a combination of excavation and temporary fill using sheet piles. In the event that soil moisture levels cannot be reduced to acceptable levels for construction equipment operation using surface water drainage and pumping alone, installation of shallow groundwater wells with submersible pumps may be considered as an additional means to aid site dewatering. As no electrical service remains to Prospect Island, all pumps would be diesel powered or electrically powered using a diesel generator.

Diesel fuel would either be stored on site, on the levee or at a staging area, or the pumps would be serviced regularly with a refueling vehicle.

Dewatering of the south property would also be accomplished using temporary diesel-powered pumps. As there are no remnant agricultural ditches on the south property, temporary drainage ditches may be excavated, with soils beneficially re-used as part of the Miner Slough eastern toe berm. As is the case for the north property, depending upon soil moisture levels attained through initial dewatering, installation of shallow groundwater wells with submersible pumps may be considered as an additional means to aid site dewatering.

Water management during construction would be accomplished by operation of the drainage pumps on a reduced operating cycle, similar to practices typical of Delta island drainage operations. Site saturation levels would be maintained as necessary to allow construction equipment to operate and maneuver within the site for the duration of construction. Specific equipment needs for accomplishing this work would be determined based on soil moisture conditions, and could include amphibious excavators, low ground pressure (LGP) excavators, or standard excavators. Appropriate maximum soil saturation tolerance levels would be determined in final design.

Following cessation of dewatering, pump platform fill material would be re-used on site, sumps filled to grade, with all equipment and temporary sheet piles removed and transported off site.

b. Clearing

This activity is necessary to allow for construction vehicle access as well as uniform characteristics of soils reused on site. Following initial site dewatering, existing vegetation would be cleared and grubbed within the construction footprint (i.e., excavated channel network, eastern toe berm and intertidal bench, site access roads/ramps, Miner Slough spur channel dredge placement area) (Table 2.2-3, Figure 2.2-4). In addition, all above ground vegetation would be cleared within moderate subtidal areas (<0 ft NAVD 88) as well as within a 100 ft buffer outside of the construction footprint. These cleared materials would be disked in place. To limit habitat suitability for ambush predators within shallow subtidal (0.0 to 2.1 ft NAVD 88) habitats, the limited number of existing trees at these elevations would be removed. Existing trees at intertidal elevations (2.1 to 6.5 ft NAVD 88) that are outside of the construction footprint and buffer areas described above would be left intact to serve as snags within future emergent wetland habitats.

This activity would require a variety of construction equipment and methods. Smaller trees, brush, and debris would be cleared using a combination of bulldozers, excavators, and wheel loaders. Any larger trees within areas designated for clearing may need to be cut down and bucked by hand crews using chain saws. Larger tree trunk/limbs and root wads (i.e., large woody debris) would, to the extent practicable, be re-used on site to enhance habitat structure along the upland edge of the intertidal zone. All plant debris not including large woody debris retained for future use would be chipped, transported, and disked within the moderate subtidal areas.

c. Creation of temporary ramps and roads, for the purpose of creating construction access into and out of the site interior

This activity would involve constructing temporary access ramps and roads within the Project site to facilitate construction. The site is currently surrounded by levees on all sides, with levee side slopes that are generally too steep to allow construction equipment to be safely driven down into the site interior. Additionally, depending on the types of equipment needed to complete construction, and on the conditions of site soils and ground surfaces, temporary access/haul roads may need to be established within the site to facilitate construction of many of the restoration features.

Where necessary, temporary access ramps and roads would be constructed by importing clean fill by barge and trucks along designated access points and routes. Access ramps and roads may be aligned with the constructed channel network and breach locations. The number, location, and dimensions of ramps would be determined during final design. Geotextile fabric base may be used as determined by engineering analyses. Ramps and roads may be surfaced with aggregate road base. Road and ramp construction would be accomplished using a combination of excavators, bulldozers, and wheel loaders.

d. Creation of temporary staging areas, for the purpose of managing construction activities

This activity would involve designating temporary staging areas to facilitate construction. Approximately 17.7 ac of land north of the northern cross levee would be used for temporary staging and parking. Additionally, a 25-ac portion of the cleared subtidal area within the Project site would be used for temporary staging (Figure 2.2-3). Staging areas would be cleared of vegetation and/or any debris. Depending on equipment types and soil and ground surface conditions, an aggregate base may be used for the subtidal staging area.

3. Invasive plant species control measures, for the purpose of reducing the potential for ecological or other invasive species impairments within the restoration site and surrounding areas

The purpose of this restoration activity would be to remove existing non-native, invasive plants found at Prospect Island. Invasive plant control would help to promote restoration success and it would help to prevent the site from becoming a source of invasive plant species dispersal into the surrounding tidal waterways.

Under current conditions, the Project site is host to several ecologically disruptive, invasive plant species. This restoration activity would involve removing existing invasive plants (to the greatest extent practicable) at the Project site prior to restoration, with a focus on controlling those species with the potential to: (1) interfere with Proposed Project ecological objectives and/or (2) to spread outside the site and degrade surrounding habitats. The most significant invasive plant species present at the site is water primrose, an aquatic weed which covers between 160–200 ac of the wetted areas of the site (Table 2.2-4). Other invasive plant species present include emergent, submerged aquatic, riparian, and upland species, including: Eurasian water-milfoil, curlyleaf pondweed, giant reed, yellow star thistle, poison hemlock, pampas grass, fennel, perennial pepperweed, wild radish, Himalayan blackberry, red sesbania, and tamarisk. Additionally, water hyacinth and Brazilian waterweed are documented in the waters adjacent to Prospect Island.

a. Aquatic invasive plant species control

For aquatic species, the first control measure would be to dewater the site (see above). This would allow physical access and maximize effectiveness of subsequent herbicide application. Following initial site dewatering, invasive aquatic plant species would be targeted in moderate subtidal habitats (< 0 ft NAVD 88) (Figure 2.2-4) using an aerial application of State Water Resources Control Board-approved aquatic herbicides (i.e., imazapyr, glyphosate, or other similar products; possibly aminopyralid, if it is approved before Proposed Project implementation) (Table 2.2-4). These materials would be cleared and disked in place (see 2b above).

b. Terrestrial invasive plant species control

Invasive terrestrial plant species would be targeted in upland habitats (Figure 2.2-4) and would be removed by mechanical methods (e.g., excavation, mowing) as well as spot application of herbicides (Table 2.2-4). These activities would be timed to coincide with specific bloom periods (Table 2.2-5). Cleared terrestrial vegetation debris would be disked on site (Figure 2.2-4).

Table 2.2-4. Removal Techniques for Aquatic and Terrestrial Non-native Invasive Plant Species

Scientific name (common name)	Approximate Extent on Prospect	Technique	Herbicide	Herbicide Timing	Mechanical Timing
AQUATIC PLANT SPECIES					
Ludwigia spp. (*peploides*-ss *montevendensis*) (water primrose)	160–200 ac	dewater, herbicide, and physical removal	tank-mix of imazapyr (est. 6 pints (pts)/ac of Habitat or Polaris), glyphosate (est. 7.5 pts/ac of Roundup Custom or AquaMaster), or other approved products	post-dewatering	post-herbicide
Myriophyllum spicatum (Eurasian water-milfoil)	50–60 ac				
Potamogeton crispus (curlyleaf pondweed)	5–7 ac				
TERRESTRIAL PLANT SPECIES					
Arundo donax (giant reed)	<0.1 ac	physical rhizome removal and cut/herbicide	spot application of glyphosate (est. 3.3 qts/ac of Roundup ProMax)	Sep–Oct	3 weeks–3 months prior to herbicide
Foeniculum vulgare (fennel)	2 ac	herbicide	spot application of triclopyr (est. 8 qts/ac of Garlon 4 Ultra)	Mar–Apr	N/A
Centaurea solstitialis (yellow star-thistle)	0.2 ac	mowing and herbicide	spot application of glyphosate (est. 3.3 qts/ac of Roundup ProMax)	Apr–May	prior to herbicide, April–May
Sesbania punicea (red sesbania)	<0.01 ac	physical and herbicide	spot application of triclopyr (est. 8 qts/ac of Garlon 4 Ultra)	Apr–May	year-round, immediately prior to herbicide

Scientific name (common name)	Approximate Extent on Prospect	Technique	Herbicide	Herbicide Timing	Mechanical Timing
Rubus armeniacus (Himalayan blackberry)	2–5 ac (estimated)	mowing and herbicide	spot application of triclopyr (est. 8 qts/ac of Garlon 4 Ultra)	Mar–Apr	Mar, immediately prior to herbicide
Cortaderia selloana (pampas grass)	<0.01 ac	mowing and herbicide	spot application of glyphosate (est. 3.3 qts/ac of Roundup ProMax)	Sept–Nov	Sep–Nov, immediately prior to herbicide
Lepidium latifolium (perennial pepperweed)	unknown	herbicide	spot application of chlorsulfuron (est. 2.5 oz/ac of Telar)	Apr–May	N/A

Table 2.2-5. Timeline of Invasive Terrestrial Plant Species Removal Techniques

<table>
<tr><th>Scientific name (common name)</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Arundo donax (giant reed)</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">Mechanical removal</td><td colspan="2">Herbicide</td><td></td><td></td></tr>
<tr><td>Foeniculum vulgare (fennel)</td><td></td><td></td><td colspan="2">Herbicide</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Centaurea solstitialis (yellow star-thistle)</td><td></td><td></td><td></td><td colspan="2" rowspan="2">Mechanical removal followed immediately by herbicide</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sesbania punicea (red sesbania)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Rubus armeniacus (Himalayan blackberry)</td><td></td><td></td><td colspan="2">Mechanical removal followed immediately by herbicide</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Cortaderia selloana (pampas grass)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Mechanical removal followed immediately by herbicide</td><td></td></tr>
<tr><td>Lepidium latifolium (perennial pepperweed)</td><td></td><td></td><td></td><td colspan="2">Herbicide</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Source: (WWR and SWS 2013)

4. Debris and old infrastructure removal

Old infrastructure has the potential to interfere with Proposed Project construction and/or with achieving Proposed Project ecological goals. This restoration activity would involve removing old infrastructure from the Project site.

Following initial dewatering, the existing pump stations and the siphon on the north property would be removed and transported off site for disposal or re-use. Additionally, the site contains remnants of dilapidated, long-abandoned structures from a complex of buildings on the north property and a collapsed residence on the south property. Other miscellaneous debris remain from agriculture uses (discarded and/or broken irrigation piping, scrap metal), recreational use (e.g., abandoned row boat, illegal duck blinds), and debris brought into the site during times when levees failed and the site was flooded.

Removal of these materials from the Project site would require a combination of bulldozers, excavators, and wheel loaders. These efforts would require access to the site interior, which would occur following dewatering. All excess and/or unusable debris would be loaded into dump trucks for removal and proper disposal off site, or ground and chipped for incorporation into fill areas on site, as appropriate.

Following site dewatering and prior to Proposed Project construction, PG&E would remove all of the existing electrical distribution infrastructure on the north property. This includes both the abandoned wooden poles (Figure 2.2-3) and downed power lines as well as an abandoned electrical distribution tower located on the west side of the north property (Figure 2.1-2).

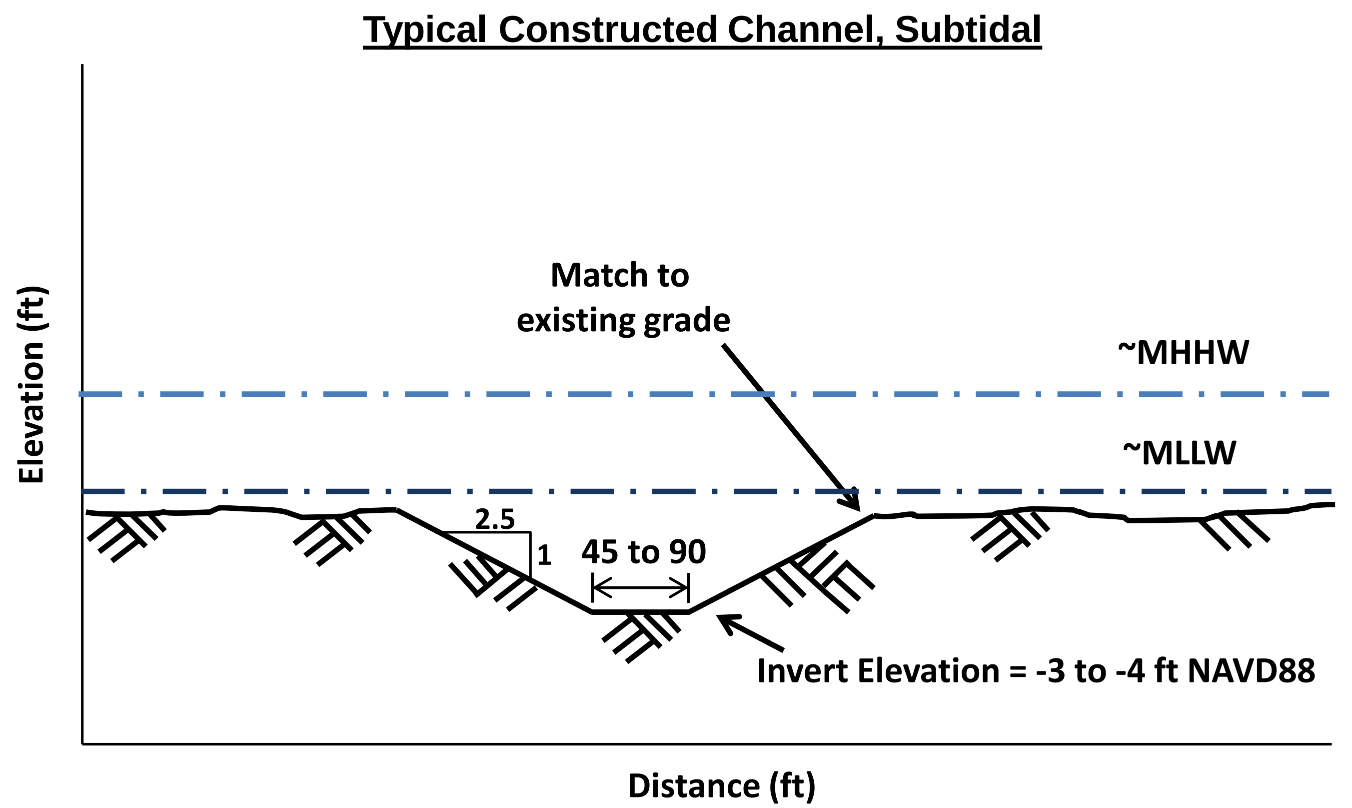
5. Excavate constructed channel network

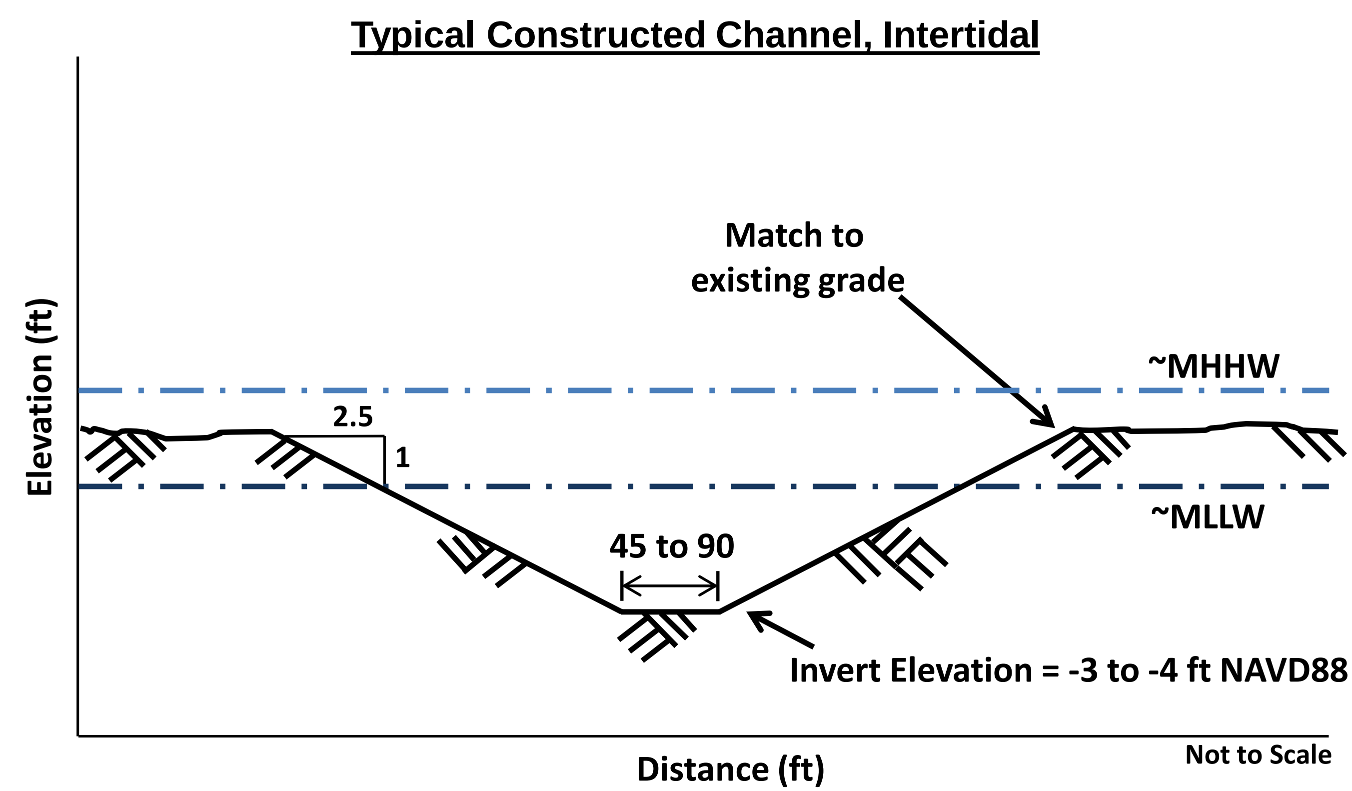
The purpose of this restoration activity would be to provide a network of tidal channels within the restored site. Excavated tidal channels would serve three functions. First, within the emergent marsh areas they would provide open water-edge habitats. Second, they would provide hydraulic connectivity and transport pathways within the restored site. Third, as the restoration site rebuilds its elevation through the natural processes of sedimentation and plant matter accumulation (aggradation), these channels would become more distinct geomorphically and serve as the “template” for the continued evolution of a tidal channel network on the site.

As part of the Proposed Project and prior to any substantial work, planned locations for soil excavation would be sampled and tested for chemical and geotechnical properties. To determine whether excavated soils are suitable for beneficial reuse in aquatic and upland areas, chemical testing of these soils would include heavy metals testing specified under CCR Title 22, Section 66261.24 (CAM 17 metals), percent solids, total recoverable petroleum hydrocarbons (TRPHs), as well as organochlorine and organophosphate pesticides. If the material does not meet environmental screening criteria, it would not be reused for the Proposed Project.

Based on preliminary design calculations, the channels would be excavated in the site interior to have approximate invert elevations ranging from -3 to -4 ft NAVD 88, invert widths of 45 to 90 ft, and side slopes of 2.5:1 (Figure 2.2-4). Channel segments connecting to breaches would have gradual longitudinal slopes. Invert widths of these connecting channel segments would narrow from the widths of the breach inverts to the widths of the constructed channel inverts at a uniform angle, over the length of the connecting segment.

For the Proposed Project, the total excavation volume for the constructed channel network is shown in Table 2.2-3. Suitable material excavated from the site would be re-used on site. Construction of the channel network would be accomplished using a combination of excavators, bulldozers, and wheel loaders.





Produced by SWS, 2014

Figure 2.2-5
Typical Constructed Channel Cross Sections

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

6. Block or fill remnant agricultural ditches

The purpose of this restoration activity would be to close-off sections of remnant agricultural ditches that would not be incorporated into the constructed channel network, so as to prevent flow capture and consequent hydraulic short circuiting.

The constructed channel network would cross several remnant agricultural ditches. This restoration activity would involve re-using soils excavated on site to block or completely fill certain remnant agricultural ditches. At the intersection of constructed channels with some of the larger of these ditches, fill soils would be placed within the ditches, up to the elevation of the surrounding subsided land surface. The lengths of these 'ditch blocks' would vary, based on the sizes and positions (intersecting angles) of the individual remnant agricultural ditches at such intersecting locations, relative to the flow velocities that can create scour.

Ditch blocks would be constructed by placing fill generated by excavation of the constructed channel network into portions of the remnant agricultural ditches and compacting the fill to levels sufficient to minimize scour potential. Construction of these features would be accomplished using a combination of excavators, bulldozers, compactors, and wheel loaders. The estimated total fill volume that would be placed in creating these site features is shown in Table 2.2-3.

7. Construct interior topographic features

The purpose of this non-structural restoration feature would be to create small patches of higher elevation intertidal habitat within the Prospect Island interior, in order to benefit marsh development and support a greater diversity of wildlife species that may use the restored site.

Interior topographic features would be created using previously excavated materials. The mounds would be built up to approximately MHW to MHHW elevation (6–6.5 ft NAVD88), with side slopes of approximately 5:1 to 10:1, and would be compacted only to the extent that would occur as a result of the use of construction equipment in placing and grading soils (i.e., levels of compaction would be incidental rather than engineered). The estimated total volume placed for creation of these features is shown in Table 2.2-3.

8. Construct eastern toe berm

The Prospect Island Miner Slough levee runs for approximately 27,600 ft (5.2 miles) along Miner Slough. The Prospect Island levees are not part of the SRFCP and do not meet Federal Emergency Management Agency (FEMA) Hazard Mitigation Plan guidance, nor are they in compliance with the USACE

PL84-99 standard (DWR 2012b). Under the Proposed Project, large portions of the Project site interior would become permanent, open water areas, with depths of up to 9 ft at high tides, and greater during winter high flow events. Therefore, levee slopes not containing rooted woody vegetation could be subject to wind-wave action leading to potential erosion of the levee slopes. The purpose of this non-structural berm along portions of the interior of the Miner Slough levee would be to protect these areas from potential wind wave erosion by supporting colonization of emergent vegetation and valley/foothill riparian habitat at appropriate intertidal elevations.

As part of the Proposed Project and prior to any substantial work, potential soils re-use locations along the eastern toe berm would be tested for geotechnical properties. The eastern toe berm would be constructed at an approximate 20:1 slope from elevation 9 ft NAVD88 down to the approximate MHHW elevation (6.5 ft NAVD88), and at an approximate 10:1 slope from MHHW down to existing grade (see Figure 2.2-6). Exact dimensions would be determined based on quantities of materials available to construct this feature. The estimated total volume placed for creation of this feature is shown in Table 2.2-3. Construction would consist of the following actions prior to levee breaching:

a. Clearing of areas within the footprint of the toe berm.
b. Placing geotextile fabric to help maintain slope stability, as determined in final design engineering analyses.
c. Transporting soils excavated during channel construction to placement locations within the toe berm footprint.
d. Grading of excavated soils to form the eastern toe berm. Compaction requirements for geotechnical stability and finish grades would be determined during final design.
e. Erosion control by hydro-seeding of native grass species as well as limited planting of native riparian vegetation at elevations along the eastern toe berm that would be above high tide following tidal restoration (see 13 below).
f. Pre-breach maintenance and water management as needed to promote Proposed Project objectives.

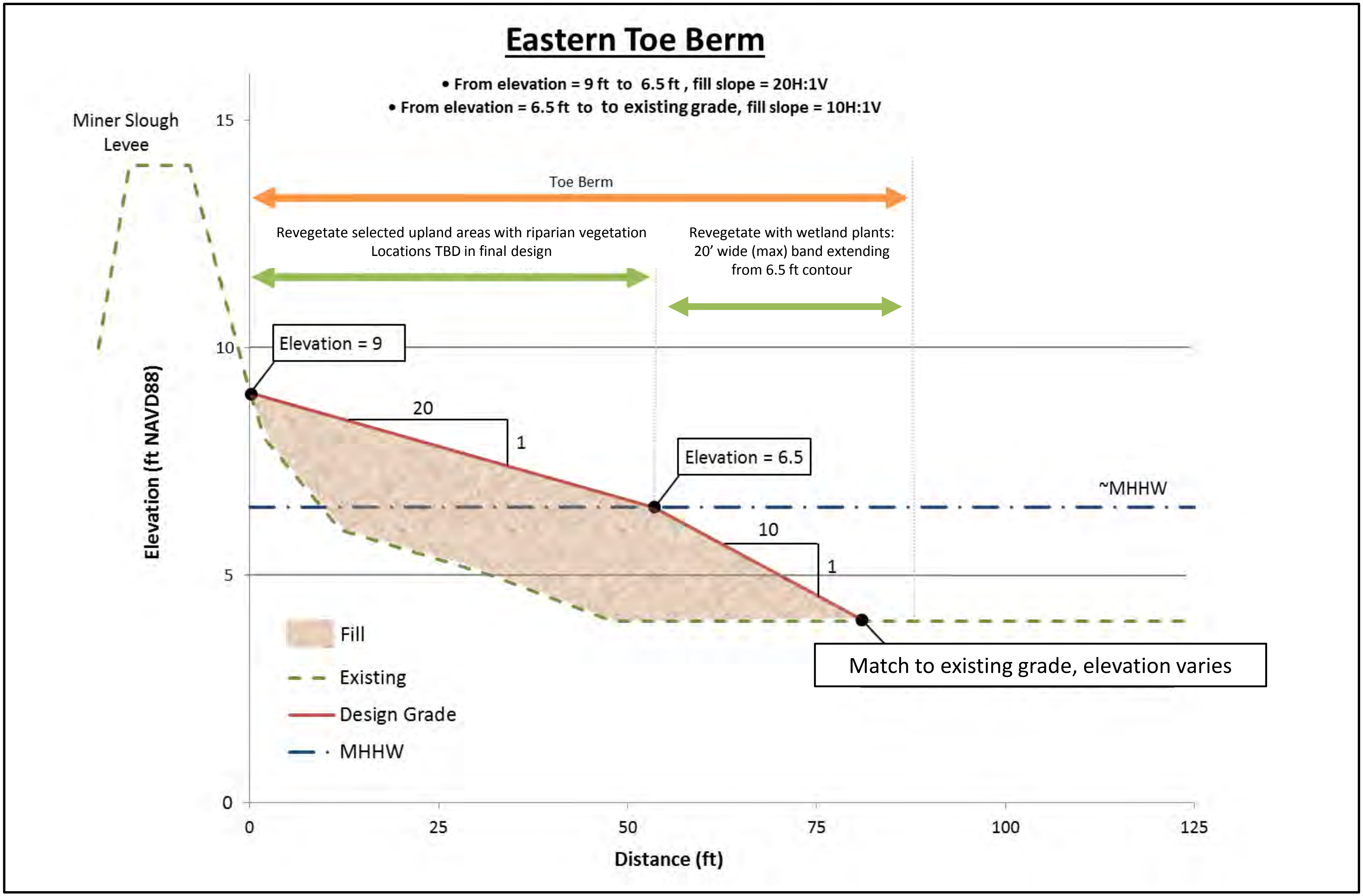


Figure 2.2-6
Eastern Toe Berm Typical Cross Section

9. Construct eastern intertidal bench

The central portion of the Project site is comprised of open water areas at subtidal elevations. The purpose of this non-structural intertidal bench would be to provide appropriate elevations for colonization of emergent vegetation and thereby protect the Prospect Island Miner Slough levee from potential wind wave erosion. Creation of this feature would involve re-use of excavated soils to construct a wide, earthen bench along the interior side of the eastern levee, to intertidal elevations, in areas where existing interior elevations adjacent to the levee are subtidal. These conditions are found from the internal cross levee north, approximately 1 mile (Figure 2.2-2).

As part of the Proposed Project and prior to any substantial work, potential soils re-use locations within the eastern intertidal bench would be tested for geotechnical properties. The bench would have a slope of approximately 10:1 from elevation 6.5 ft NAVD88 (MHHW) to 3.5 ft NAVD88. The slope would then decrease to 280:1 from elevation 3.5 ft NAVD88 to 2.1 ft NAVD 88 (roughly MLLW), and at 5:1 from 2.1 ft NAVD 88 until the bench edge elevation reaches existing grade (Figure 2.2-6). The estimated total volume placed for creation of this feature is shown in Table 2.2-3. Exact dimensions would be determined based on quantities of materials available to construct this feature. Construction would consist of the following activities, which would be implemented prior to restoring tidal action:

a. Clearing of areas within the footprint of the intertidal bench.
b. Placing geotextile fabric near the bench toe transition to existing grade to help maintain slope stability, as determined in final design engineering analyses.
c. Transporting soils excavated during channel network construction to placement locations within the intertidal bench footprint.
d. Grading of soils. Compaction requirements for geotechnical stability and finish grades would be determined during final design.
e. Native wetland vegetation may be planted in areas that would form open water edge habitat following breaching (see 13 below).
f. Maintenance and water management as needed to promote Proposed Project objectives.

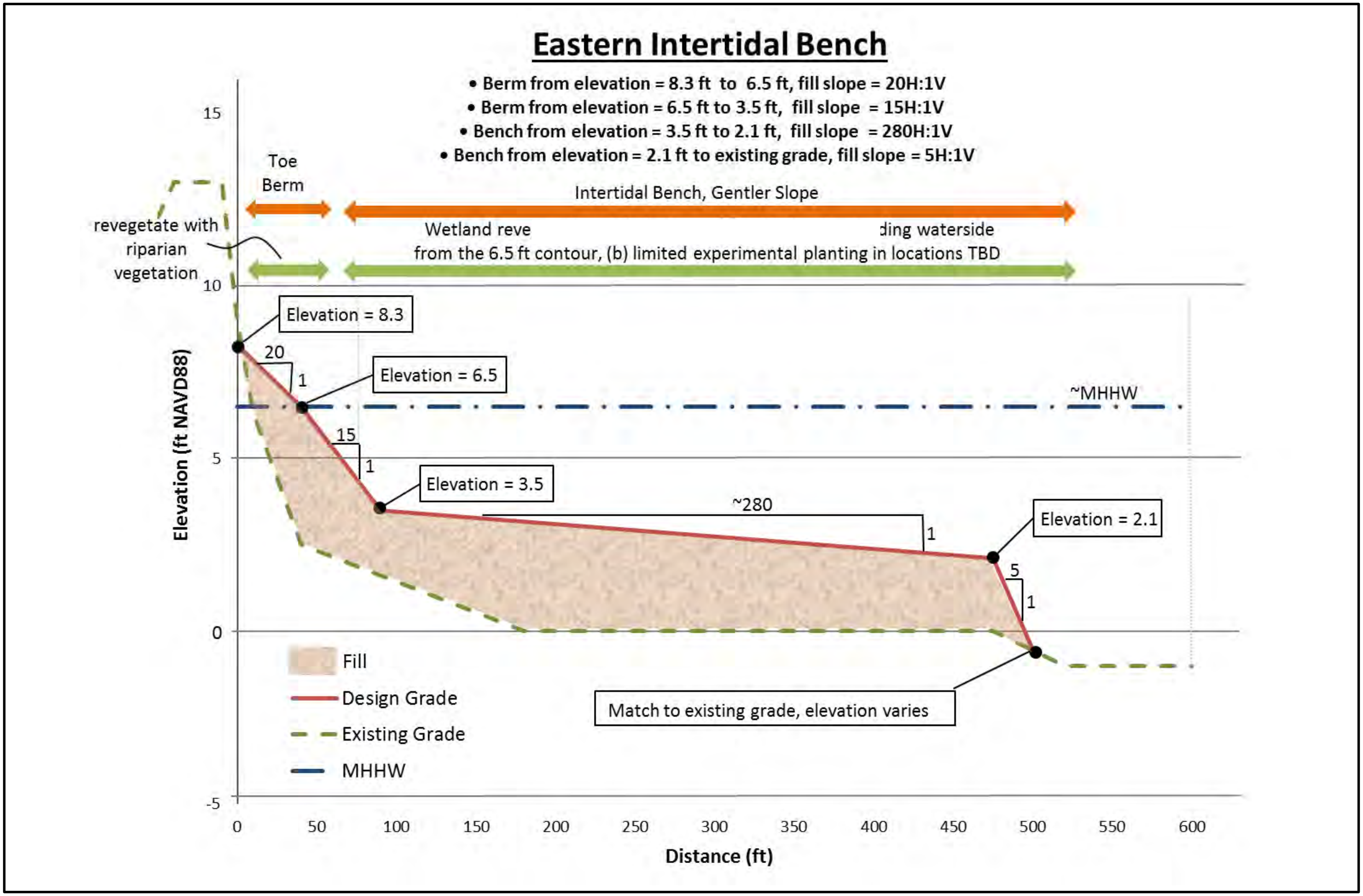


Figure 2.2-7

Eastern Intertidal Bench Typical Cross Section

10. Excavate internal cross levee

The purpose of this restoration activity would be to provide hydraulic connection between the north and south properties following breaching of the Miner Slough levee.

As part of the Proposed Project and prior to any substantial work, planned locations for soil excavation would be sampled and tested for chemical and geotechnical properties. To determine whether excavated soils are suitable for beneficial reuse in aquatic and upland areas, chemical testing of these soils would include CAM 17 metals, percent solids, TRPH, as well as organochlorine and organophosphate pesticides. If the material does not meet environmental screening criteria, it would not be reused for the Proposed Project.

The internal cross levee would be excavated to provide an opening with cross sectional area matching that of the south breach. The invert elevation would be at -4 ft NAVD88, to match that of the constructed channel network in the south property and the existing grade in the north property adjacent to the cross levee. Invert width would be approximately 395 ft, with side slopes of approximately 2.5:1 (Figure 2.2-7).

Excavated soils would be used to fill the existing borrow ditch that runs along the north side of the internal cross levee to elevation -3ft NAVD88 at the notch location. Fill in the borrow ditch would extend at least 100 ft to either side of the cross levee to create ditch blocks.

This activity would be accomplished using excavators. Excavators and/or bulldozers would place and grade a portion of the excavated soils into the borrow ditch. Excavation volumes are shown in Table 2.2-3.

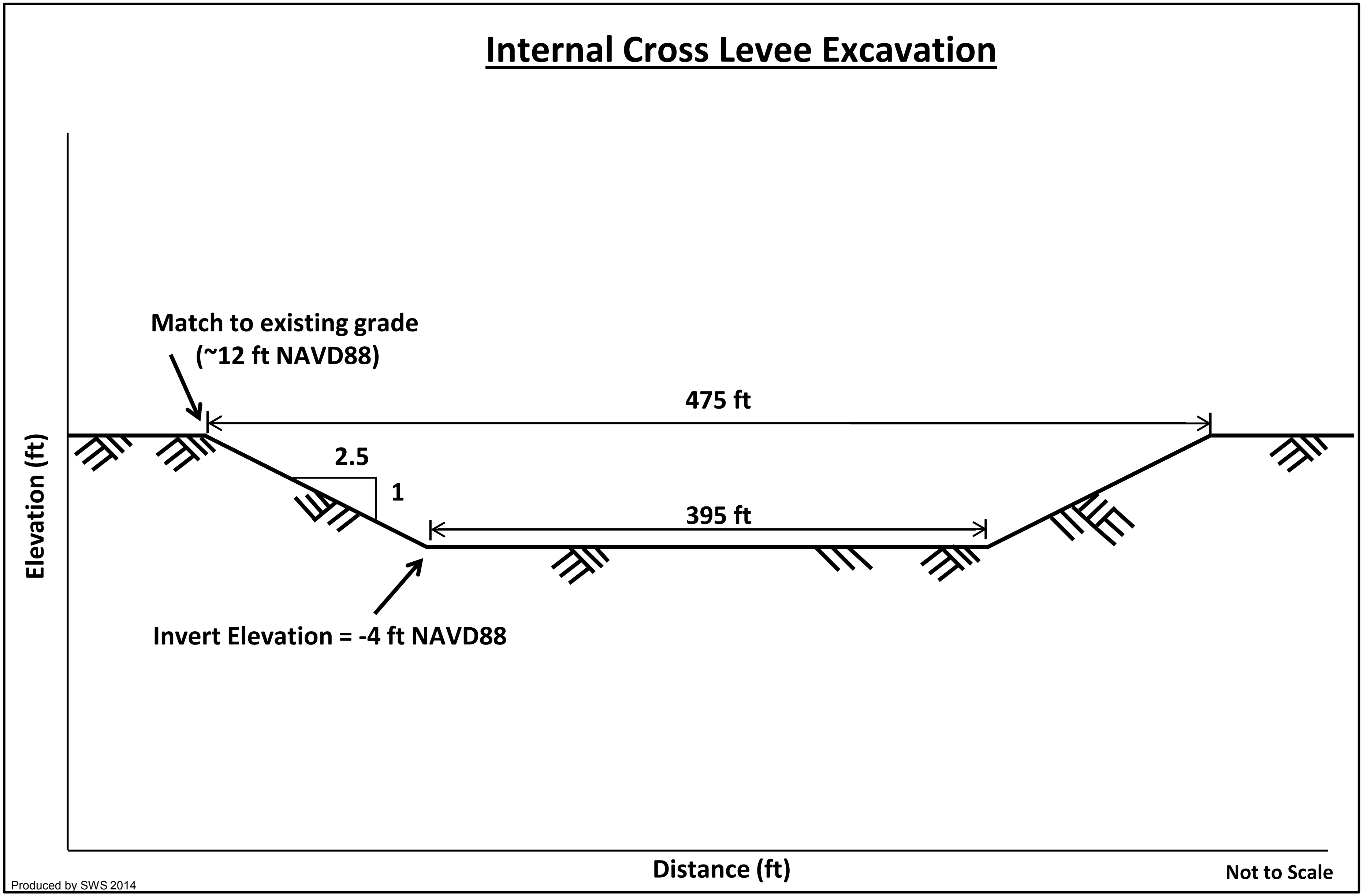


Figure 2.2-8

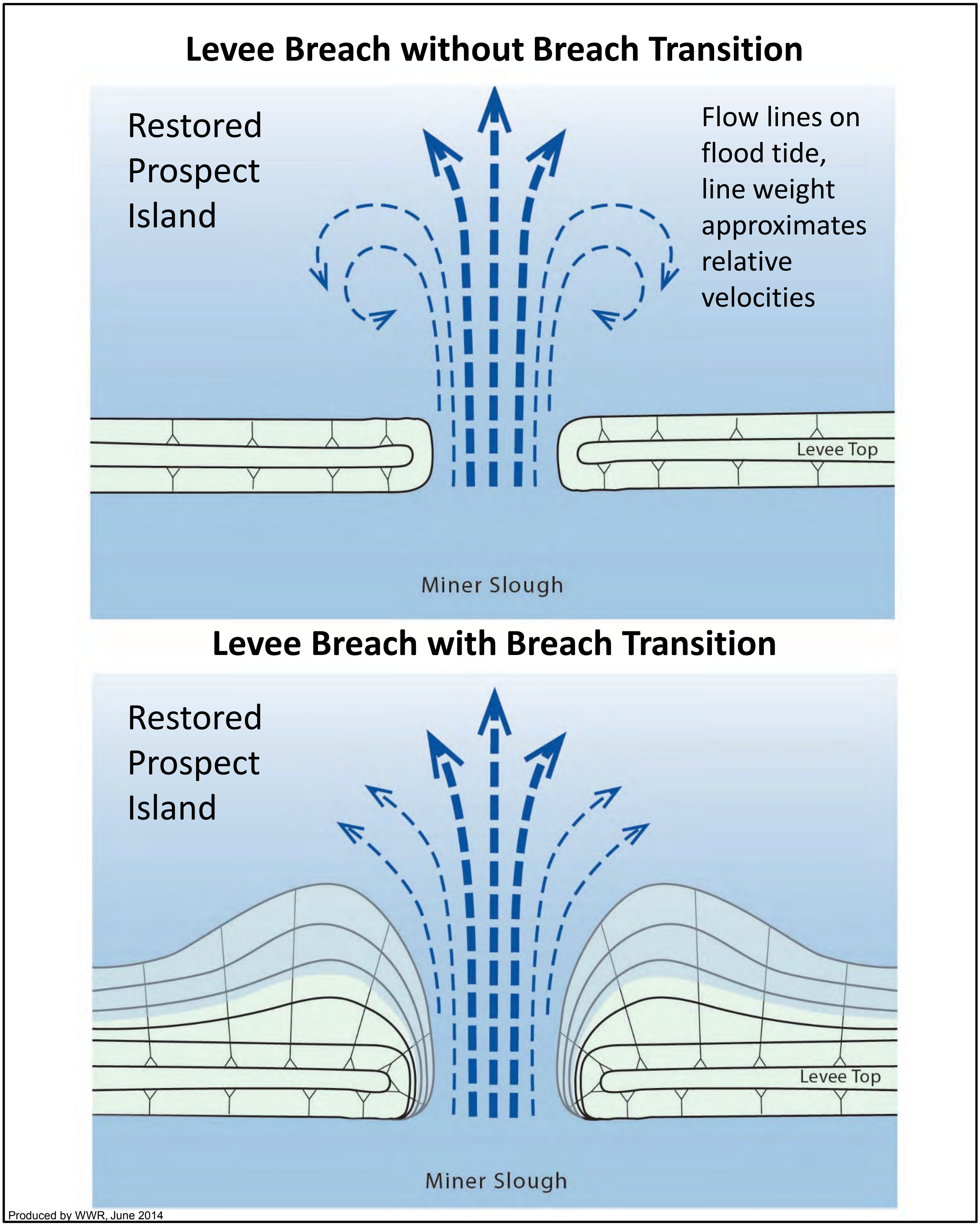
Internal Cross Levee Excavation Cross Section

11. Construct breach velocity dissipation features

The purpose of constructing breach velocity dissipation features on the interior ends of the levee breaches is to test an experimental design intended to minimize strong velocity gradients where predatory fishes are known to congregate and prey successfully on smaller fishes.

Hydrodynamic modeling conducted for the Proposed Project indicates that the proposed levee breaches would create velocity gradients and associated eddies on the internal sides of these breaches. Although no direct studies of higher predation rates effects within low velocity eddies adjacent to levee breaches have been identified, anecdotal observation of fish congregations within these areas suggests that predatory fish species preferentially seek out these habitats for foraging. USFWS and USBR monitoring of fish habitat use during gate operations in the 1990s at the Red Bluff Diversion Dam on the Sacramento River showed increased presence of Sacramento pikeminnow in turbulent areas, with striped bass habitat use concentrated along the turbulent eddy line adjacent to the gate structure (Tucker et al. 2003). In studies of smallmouth bass, velocity refugia afforded by structures was hypothesized to allow fish to forage in high velocity areas that would otherwise be energetically unfavorable (Rankin 1986). In addition, anglers often congregate at levee breaches and other locations that offer these strong velocity gradients, as well known locations for successful fishing.

Prior to breaching the levee, gradually sloping grade transitions would be constructed at one breach location. This would be accomplished by placing fill excavated in construction of the channel network onto the interior side of the levee, and grading to the appropriate design dimensions (Figure 2.2-8). The breach interior would slope downward longitudinally along the banks of the constructed channel inside the breach and laterally along the interior toe of the levee. Construction of these features would utilize a combination of excavators and bulldozers. Compaction requirements would be determined during final design. Revegetation measures (if any) would be determined during final design and, if employed, would be similar to those described above for the eastern toe berm.



Produced by WWR, June 2014

Figure 2.2-9

Breach Velocity Dissipation Feature

12. Dredge Miner Slough spur channel

The purpose of this restoration activity is to ensure that unimpeded tidal exchange occurs through the southern breach to Miner Slough.

This restoration feature would involve dredging of the spur channel between Miner Slough and the south breach location. Hydraulic modeling results show that the current geometry of the Miner Sough spur channel is undersized for the anticipated volume of tidal exchange between Miner Slough and the restored Project site, and would, therefore, result in tidal dampening within the Project site.

Dredging would occur after the south property levee is repaired and prior to breaching the Project site. Current depths in the spur channel range from -5 to -8 ft NAVD88. Preliminary design would lower the channel invert elevation to -16 ft NAVD88. The channel width would remain unchanged. Channel side slopes would vary between 2:1 and 1.5:1. The volume of material to be dredged from the spur channel is shown in Table 2.2-3.

As part of the Proposed Project and prior to any substantial work, soils within the Miner Slough spur channel, as well as soils within the dredged materials placement area, would be characterized (Kinnetic 2015). Underwater sampling of the spur channel would use boat-mounted Vibracore equipment and small diameter (4-inch) cores. Sampling and testing of these areas is to be carried out with guidance from the *Inland Testing Manual* (USEPA and USACE 1998) for dredge materials and the *Upland Testing Manual* (USACE 2003) for the upland disposal of dredge materials with further guidance from the *Delta Dredging and Reuse Strategy Report* (CVRWQCB et al. 2002).

If the dredge material meets environmental screening criteria, mechanical dredging of the Miner Slough spur channel would be accomplished by clamshell bucket with appropriate turbidity control measures (e.g., silt curtains) employed during dredge operations at the entrance to the spur channel. All excavated materials would be transported by barge to the designated placement area within the south property (Figure 2.2-2) or may be beneficially re-used at one or more locations within the Project site. Because mechanically dredged sediments typically have a solids content comparable to that of *in situ* sediments, it is expected that evaporative drying during handling and after placement would be sufficient for dewatering with no decant or drainage water discharge to the exterior waterways surrounding the Project site.

13. Planting and revegetation

Native wetland vegetation may be planted in areas that would form open water edge habitat following breaching of the Miner Slough levee (i.e., highly energetic areas subject to undampened wind wave energy). This includes areas up to a maximum width of 20 feet along exposed portions of the eastern toe berm (Figure 2.2-6) as well as the eastern intertidal bench (Figure 2.2-7). In addition, a larger experimental plot of wetland vegetation would be planted along the intertidal bench to provide information on the relative success of planting methods and to compare vegetation establishment between planted and unplanted areas. The remainder of the intertidal bench would be left unplanted to allow for natural colonization. Plot locations, dimensions, and planting methods would be determined during final design.

Following construction, hydro-seeding of native grass species will be used for erosion control of bare soil along interior levee slopes. In addition, planting of native riparian vegetation, containing both canopy and understory trees and shrubs, would occur along upper slopes of the eastern toe berm, within the upland staging area to the north of the Project site, as well as along the interior of the DWSC levee. Specific locations and extents of riparian revegetation zones, plant species composition, planting methods, and initial irrigation requirements would be determined during final design.

14. Remove access roads and ramps

Following construction of the Proposed project, materials used for the construction of temporary access road and ramps would be beneficially reused to the extent practicable (e.g., for re-surfacing levee roads, interior topographic features, intertidal bench, etc.). One to three access roads would be kept in place for future monitoring access.

15. Breach Miner Slough levee

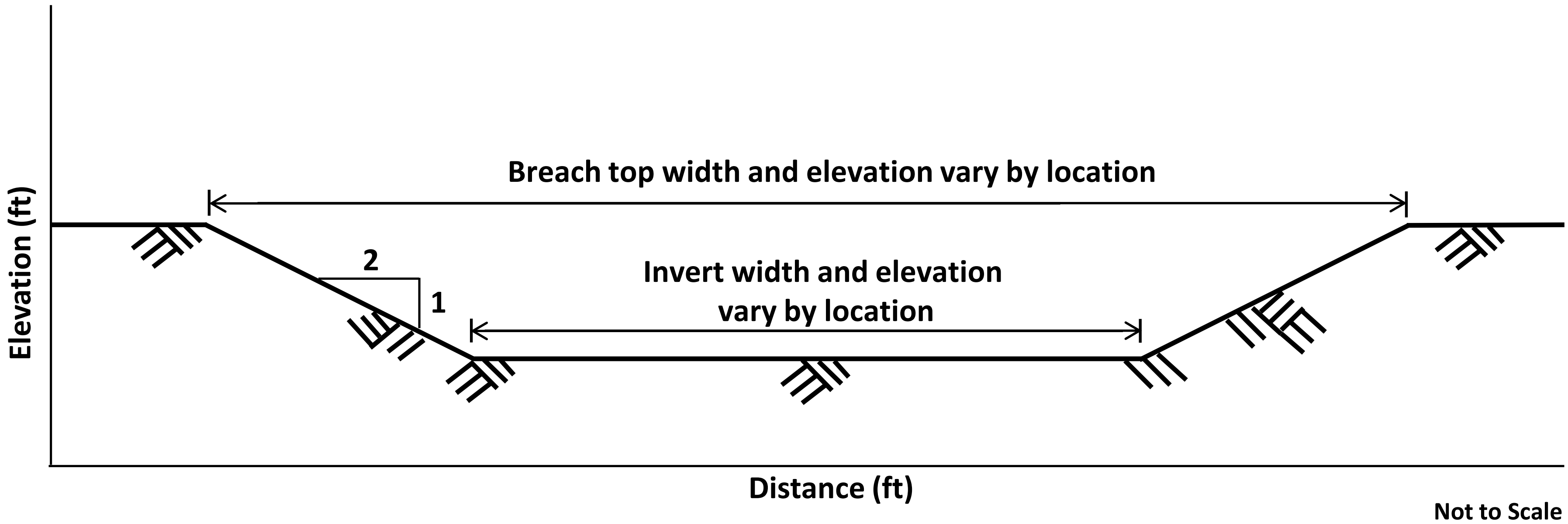
The purpose of this restoration activity is to reconnect the Project site to tidal action and is the final step in the restoration construction process. This restoration activity would involve excavating two levee breaches to Miner Slough. One breach would be located in the north portion of Prospect Island, approximately 0.5 miles south of Arrowhead Harbor Marina. The second breach would be located in the south property, at the location of the formerly repaired breach connecting to the Miner Slough spur channel (Figure 2.2-2).

As part of the Proposed Project and prior to any substantial work, planned locations for levee breaching would be sampled and tested for chemical and geotechnical properties. To determine whether excavated soils are suitable for beneficial reuse in aquatic and upland areas, chemical testing of these soils would include CAM 17 metals, percent solids, TRPH, as well as organochlorine and organophosphate pesticides. If the material does not meet environmental screening criteria, it would not be reused for the Proposed Project.

Levee breaching would be accomplished using excavators. The material excavated from the levee would be handled in one or more of the following ways: (1) directly placed within the site interior near the levee breach, (2) spread on the top or interior side slopes of the levee as reinforcement, (3) loaded into dump trucks and hauled to other areas of the Project site for re-use, (4) or loaded into dump trucks and hauled off site. Materials excavated from portions of the levee that are above the high tide line would be readily moved and re-used within the site. Once excavation levels drop below the elevation of high tide and tidal waters may enter the site, placement of excavated soils would, for the most part, be limited to areas in the immediate proximity of the breach or on the levee, or the soils would be removed from the site. Total excavation volumes for the breaches above and below MHHW are shown in Table 2.2-3.

To protect the remaining adjacent levees from erosion, rock slope protection may be placed on the interior, exterior, and levee end slopes near the breach (Figure 2.2-9). The rock slope protection would be imported using barge and trucks, and would be placed from the levee crest down to the base of the slope in the water.

Miner Slough Levee Breach(es)



Location	Top Width (ft)	Top Elevation (ft NAVD 88)	Invert Width (ft)	Invert Elevation (ft NAVD 88)
North property	610	16	510	-4
South property	477	9 to 16	394	-4

Figure 2.2-10
Miner Slough Levee Breach(es) Cross Section

Construction schedule for the Proposed Project

The purposes of providing an implementation schedule for the Proposed Project are to determine the time frames during which construction activities would take place, for CEQA evaluation, and to optimize sequencing and seasonality of construction activities to allow for the shortest viable construction duration. Table 2.2-6 provides the estimated construction implementation schedule.

Table 2.2-6. Estimated Construction Implementation Timing

Restoration Activities	Start Date	End Date
Construction [1-5]	**4/10/2018**	**10/30/2020**
Terrestrial invasive spp. control[6]	4/10/2018	4/23/2018
South property levee repair[5]	7/2/2018	8/3/2018
Dredge Miner Slough spur channel[5]	7/1/2019	10/31/2019
Planting and revegetation [2]	12/2/2019	10/30/2020
Miner Slough levee breaches[5]	7/1/2020	10/30/2020
Plant irrigation	4/1/2019	10/30/2021

1 Includes site preparation, dewatering, aquatic invasive plant species control, clearing, excavation, fill and grading.
2 Restoration activities in terrestrial habitats limited to May 1 to October 1 for the protection of Giant Garter snake unless site has been cleared.
3 Removal of mature trees, snags, or remnant structures will be limited to Sept- April for the protection of Western Red Bat.
4 Nesting bird surveys needed 14 days prior to construction if work takes place during Mar 15 to Aug 15, with clearing and construction activities allowed from Aug 16 to Feb 14.
5 Dredging, underwater excavation, and other in-water work in tidal waters limited to July 1 to October 31 for the protection of aquatic species.
6 Timing of control technique varies by species (Table 2.2-4).

Post construction site maintenance, monitoring, and adaptive management activities

Following construction of the Proposed Project, the DWSC levee would continue to be maintained as a Navigation Project Levee, and the Port would continue to be responsible for all necessary inspection and maintenance activities. DWR would continue to inspect and manage the northern cross levee on the Project site as required, and any damage with the potential to impact public safety would be repaired.

Restoration project monitoring following construction would focus on three general areas: (1) evaluating how the site is meeting the overall Proposed Project objectives, (2) evaluating the need for any corrective measures to address potential problems, and (3) gathering scientific information for testing tidal restoration hypotheses to contribute to regional adaptive management science. The activities presented here are not intended to be exhaustive, but to provide a broad indication of site-level monitoring that would be detailed later in a separate Monitoring Plan. The general suite of monitoring activities may be included in a Monitoring Plan, include the following broad categories:

- Geomorphology
- Hydrology
- Vegetation communities
- Water quality
- Aquatic food web and fishes

In addition, post-construction monitoring of the Project site would be necessary to identify potential problems and formulate corrective measures for addressing them. Potential problems that could occur at the Project site include:

- Colonization and establishment of invasive aquatic weeds
- Colonization and establishment of invasive wetland and upland plants
- Colonization by invasive fish
- Levee instability/erosion
- Harmful algal blooms

Lastly, in the context of regional ecosystem restoration adaptive management, studies may take place at Prospect Island, utilizing the design itself as the study subject.

3 ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION MEASURES

BIOPHYSICAL RESOURCES

3.1 Hydrology (Surface and Groundwater)

3.1.1 Setting

This section describes the existing hydrologic conditions on Prospect Island and in the general vicinity, and assesses potential Proposed Project-related impacts and associated mitigation measures.

Prospect Island is located in the northern Delta at the south eastern edge of the CSC (Figure 2.1-1). It is part of the Sacramento River Flood Control Project and is within the boundaries of the Yolo Bypass Floodway. The location of Prospect Island at the hydrological intersection of the CSC and the Sacramento River system results in a complex hydrological setting that exhibits distinct conditions, processes, and areas of effect depending on the time of year.

Environmental setting

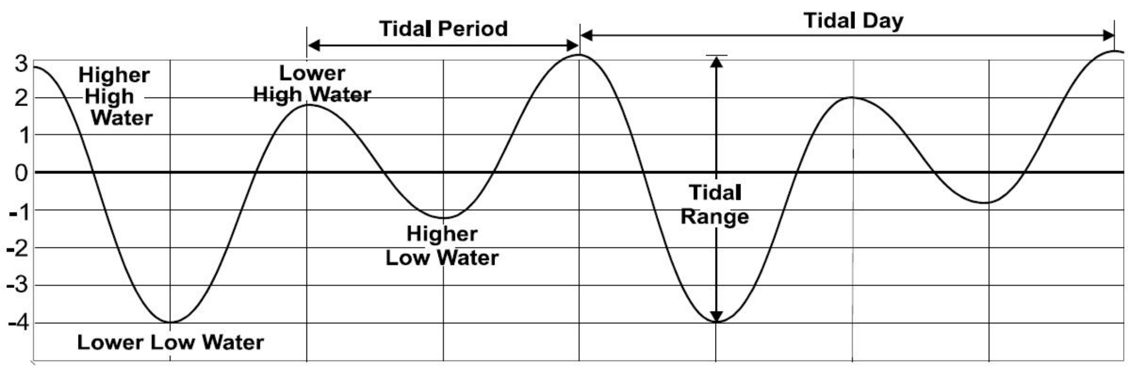
Prospect Island's hydrologic setting is presented by geographic scale including a brief, general description of Delta hydrology to provide regional context, a more detailed description of conditions within the northern Delta and the CSC, and a summary of local hydrologic conditions in the vicinity of and within Prospect Island.

Sacramento-San Joaquin River Delta

The Sacramento-San Joaquin River Delta is an expansive inland river delta and estuary that formed at the western edge of the Central Valley by the confluence of the Sacramento and San Joaquin rivers. The Delta receives run-off from approximately 40% of the land area of California, and approximately 50% of California's total stream flow (Strange 2008). Surface water flows in the Delta are extremely complex and are defined by river inflows, tides, flood conveyance, and water supply operations.

Dams in the Sacramento and San Joaquin river watersheds upstream of the Delta capture water and reduce downstream river flows during approximately November through April. During May through October, water is released for agricultural and municipal water supply. This managed hydrologic regime directly contrasts that of the historical unimpaired regime in the Delta, which exhibited high winter and spring flows (from rainfall and snow melt) and low summer and fall flows (during the dry season).

Tides, or the rise and fall of sea levels due to gravitational forces exerted by the moon, sun, and the rotation of the Earth, influence the Delta. The Delta experiences a mixed, semi-diurnal tidal cycle, which corresponds to two unequal tides each day including higher-high, high, low, and lower-low water levels (Figure 3.1-1). The latter are standard terms called *tidal datums*, which are used to describe the elevations of tides relative to a geodetic (earth surface) reference and are updated approximately every 25 years to adjust for long-term changes in mean sea level.



Source: NOAA 2003.

Figure 3.1-1. Diagram of Mixed, Semi-Diurnal Tides of the San Francisco Estuary

Regional tides diminish in amplitude and rise in mean level from the Golden Gate Bridge into the Delta (DWR 2004). This pattern reflects absorption of tidal energy as the tide wave moves inland and meets incoming river flows.

Numerous water supply withdrawals occur from the Delta, including exports for the State Water Project and Central Valley Project, diversions to the Contra Costa Water District, and local agricultural diversions. Flows in the Delta also are managed via upstream reservoir releases and in-channel control structures to meet water quality objectives to support municipal, industrial, agricultural, and fish and wildlife needs. One of these structures, the Delta Cross Channel (DCC), is located on the Sacramento River about 30 miles downstream of Sacramento, in Walnut Grove (USBR 2013). The DCC diverts water from the Sacramento River into a branch of the Mokelumne River to manage salinity intrusion into the Delta, dilute local water pollution, and improve the quality of irrigation water supplies in the Central Valley (USBR 2013). The South Delta Temporary Barriers Project is another set of in-channel structures operated by DWR in four locations in the South Delta: the Head of Old River, Old River at Tracy, Middle River, and Grant Line Canal (DWR 2015). Temporary rock-fill barriers are seasonally placed in channels to protect migratory fish and provide adequate agricultural water supply.

Projected mean sea level rise

The California Climate Change Center's *Third assessment on climate change* explores a regionally focused range of potential mean sea level rise scenarios and associated impacts in the San Francisco Bay area based on a set of climate scenarios prepared for the California Energy Commission's Public Interest Energy Research Program (Ekstrom and Moser 2012). Over the past century, mean sea level at the San Francisco Tide Station (CA Station ID: 9414290) has risen approximately 8 inches (0.7 ft), which is consistent with global mean sea level rise (Hanak et al. 2011). Under the medium to medium-high emissions scenarios, mean sea level is projected to increase by 3.3 to 4.6 ft by the year 2100 (Ekstrom and Moser 2012). Similar sea level rise projections (1.38 to 5.48 ft) are reported by the Coastal and Ocean Working Group of the California Climate Action Team (2013) for the coastline south of Cape Mendocino, which are in turn based on findings in the National Research Council report on Sea Level Rise for the Coasts of California, Oregon, and Washington (2012).

Cache Slough Complex

The CSC is a 53,000-ac region of low-lying land in the northwest portion of the Delta (Figure 2.1-1). A network of tidal sloughs surrounds the diked, subsided lands of the CSC, converging into the main stem of lower Cache Slough upstream of its confluence with the Sacramento River. Along the eastern edge of the CSC runs a segment of the DWSC, a 30-ft deep navigation channel that extends from the confluence of the Sacramento and San Joaquin rivers to the Port of West Sacramento. Surface water flows in the sloughs surrounding the CSC and in the DWSC are primarily defined by tides, flood conveyance, and water supply operations.

Sacramento River Flood Control Project and the Yolo Bypass

The SRFCP addresses Sacramento Valley's basin-wide flooding and drainage problems and was completed by local, state, and federal agencies in 1948. As part of the SRFCP, levees were constructed and strengthened along the Sacramento River and the Yolo Basin, creating the Yolo Bypass Floodway. Levees also were constructed or strengthened along many of the tidal waterways in the CSC and the sloughs and channels east of Prospect Island, including along the eastern bank of Miner Slough adjacent to Prospect Island. Miner

Slough conveys flows from the Sacramento River, via Sutter Slough, to Cache Slough (Figure 2.1-1). The design flow of Miner Slough, as part of the SRFCP, is 10,000 cubic feet per second (cfs) (USACE 2006), which falls between a 1.5- and 2-year recurrence-interval flow. Water surface elevation relating to this flow varies by tidal conditions (cbec and WWR 2012).

The Yolo Bypass provides flood protection to the City of Sacramento and other nearby cities and farmland by capturing and diverting up to 455,000 cfs of floodwaters from the Sacramento River, through the Fremont and Sacramento weirs (CDFG and Yolo Basin Foundation 2008). The Yolo Bypass was constructed in 1924 and has undergone one major modification since that time—the completion of the DWSC in 1963 (CDFG and Yolo Basin Foundation 2008), which separated Prospect Island and Little Holland East from the main body of the Bypass. Prospect Island was included in the SRFCP with “restricted height” levee requirements in order to allow it to function as a high-stage overflow basin. A restricted height levee is a levee whose maximum elevation is limited so that water may overtop the levee during storm events, converting the land usually protected by the levee into a flood storage basin. This function remains today.

Agricultural and municipal diversions and drains

A large number of agricultural diversions and drains are located throughout the CSC. During summer, irrigation return flows and groundwater seepage from the surrounding sloughs and channels collects in the drains in subsided agricultural islands; it is then pumped back to the surrounding sloughs and channels. In the winter, the agricultural drains collect and pump primarily stormwater run-off from the islands to the surrounding sloughs and channels.

The North Bay Aqueduct (NBA) is part of the SWP. It draws water from the Barker Slough Pumping Plant, at the western edge of the CSC. Barker Slough is a dead-end tidal slough except during winter rain events, when water that is normally impounded in Campbell Lake is released to Barker Creek and discharges to Barker Slough at the Barker Slough Pumping Plant Forebay. Both the Barker Slough Pumping Plant and the NBA are managed by the Solano County Water Agency. Diversions from the Barker Slough Pumping Plant provide drinking water to the cities of American Canyon, Benicia, Calistoga, Fairfield, Napa, Vacaville, Vallejo, and Yountville, as well as to Travis Air Force Base. The design capacity of the aqueduct is 175 cfs; however, the maximum diversion capacity is currently 140 cfs. Typical mean monthly diversion rates from Barker Slough Pumping Plant range from a low of 10 cfs in the winter to a high of 120 cfs in the summer.

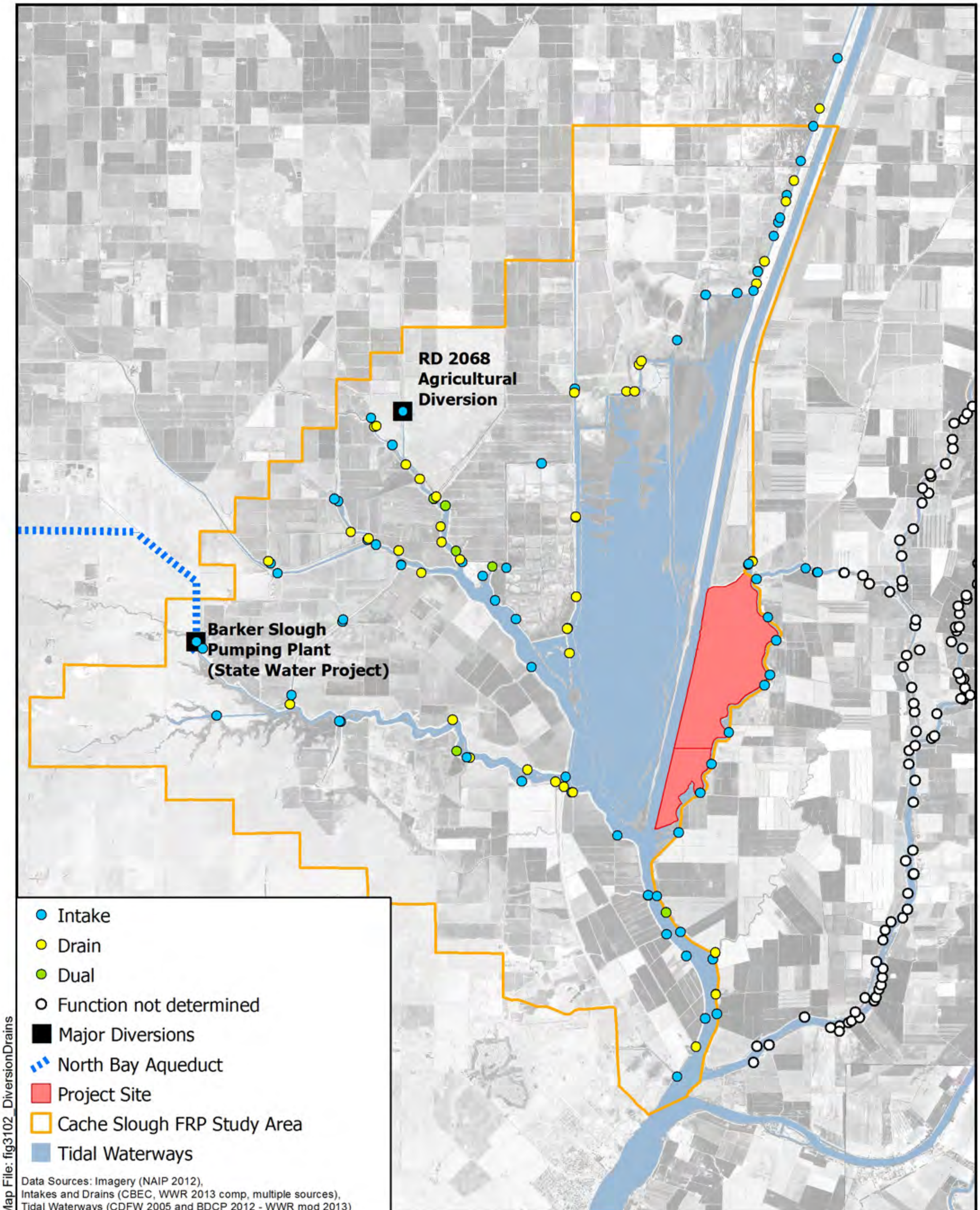


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Figure 3.1-2
Diversions and Drains in the Project Vicinity

Seasonal patterns in surface water hydrology

Distinctly different hydrologic conditions and processes have been observed in the CSC during the summer (agricultural irrigation during the dry season) and winter (no irrigation, combined with the region's conveyance of storm and flood flows). These seasonal changes and conditions are discussed below to provide context for the assessment of potential impacts associated with flow and velocity changes under the Proposed Project. Flows expressed as positive values represent the "downstream" direction that equate to ebb tides, and negative values represent the "upstream" direction that equate to flood tides.

In the summer, CSC hydrology is influenced primarily by the tidal regime and agricultural and water supply diversions (Figure 3.1-3). The tidal exchange of the CSC (as measured at the U.S. Geological Survey (USGS) Cache Slough at Ryer Island station) is approximately ±100,000 cfs. Due to the numerous agricultural diversions within the CSC, the water supply diversion at the Barker Slough Pumping Plant, and Yolo Bypass diversions via the Lisbon Weir in the Toe Drain, the system can experience a net upstream flow of up to 3,000 cfs. Miner Slough, Steamboat Slough, and the Sacramento River all have a net downstream flow into the CSC in addition to their respective tidal exchanges. The Sacramento River has tidal exchange of +15,000/-10,000 cfs, with summer month river flows varying between 2,000 and 6,000 cfs. Miner Slough and Steamboat Slough have river flows varying between 1,000 and 3,000 cfs and 1,500 and 5,000 cfs, respectively. The tidal exchange varies with both river flow and DCC operation. In general, when river flow in Miner and Steamboat sloughs is higher (when the DCC is closed), the sloughs are river-dominated and the flood tide flow is lower. When the DCC is open and flows are being diverted from the sloughs to the Mokelumne River, the system is still river-dominated. For example, when the DCC is open and Miner Slough river flow is at 1,000 cfs, tidal exchange is +5,000/-3,000 cfs. When river flow increases to 2,500 cfs, tidal exchange becomes even more ebb (river) flow-dominated with +5,250/-500 cfs. In addition, during summer months, cross-sectional average velocity in Miner Slough peaks around 1.75 fps.

In the winter, CSC hydrology is dominated by storm flows and large-scale flood control operations (Yolo Bypass, Sacramento River Flood Control Project) and pumped drainage from the diked agricultural lands (Figure 3.1-4). During non-storm events, winter flow in the CSC includes tidal exchanges of ±100,000 cfs in Cache Slough and flows in Miner Slough, Steamboat Slough, and the Sacramento River are similar to, but slightly larger than, summer flows. Cross-sectional average velocity in Miner Slough peaks around 4 fps during this time.

During storm events, river flows dominate Miner Slough, Steamboat Slough, and the Sacramento River, overwhelming the tidal exchange. These flows, combined with flow draining from the Yolo Bypass, can cause Cache Slough to become river-dominated. An example of the storm flow dominance can be seen in Figure 3.1-5. A mid-March 2011 storm event resulted in river flows in the Sacramento River, Steamboat Slough, and Miner Slough high enough to overwhelm the tidal exchange in these waterbodies. This storm also inundated the Yolo Bypass. The combination of these flows overwhelmed the normal ±100,000 cfs tidal exchange in Cache Slough, causing the system to be river-dominated with ebb flows ranging from 50,000 to 150,000 cfs and no flood tides observed.

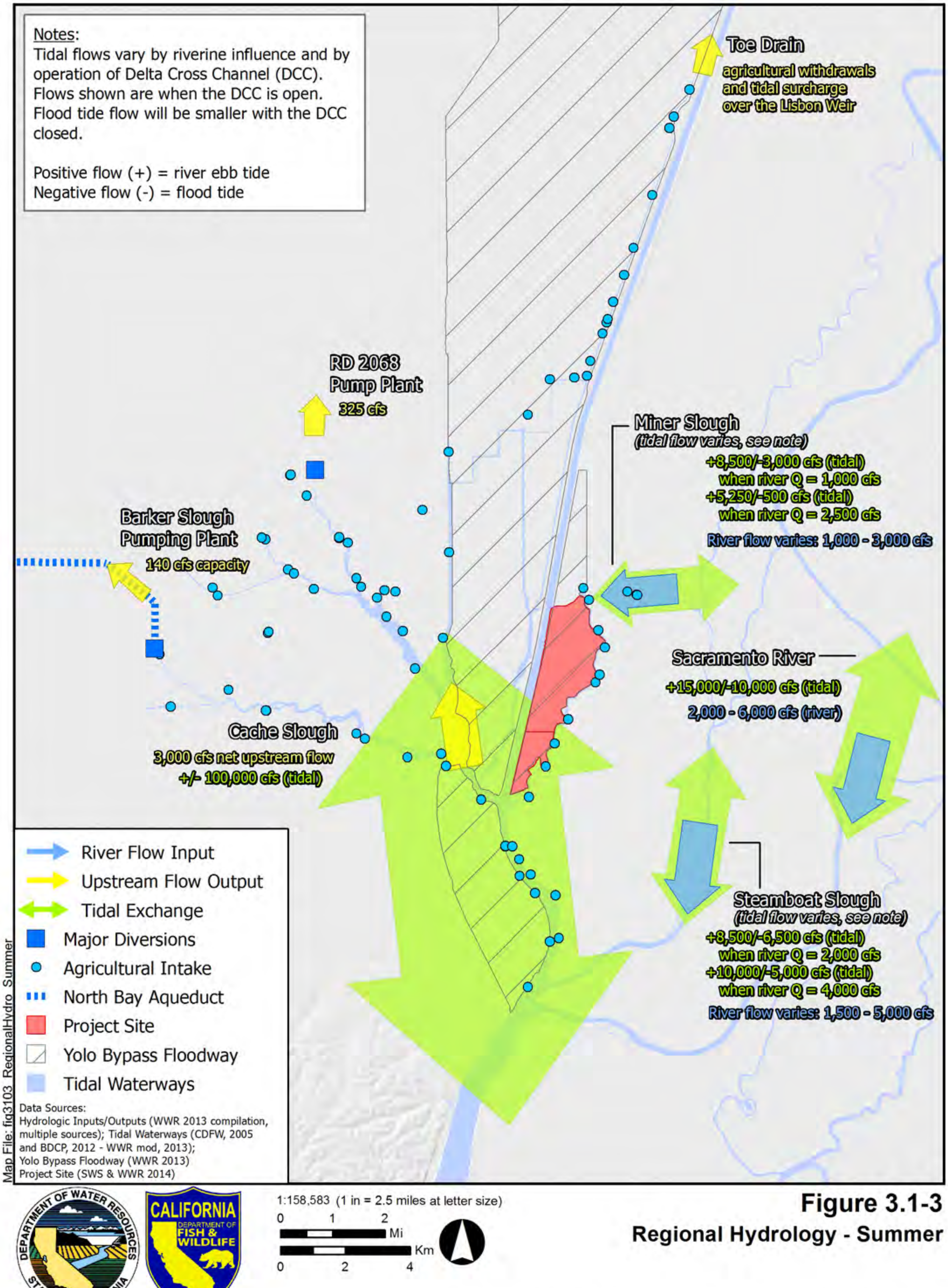


Figure 3.1-3
Regional Hydrology - Summer

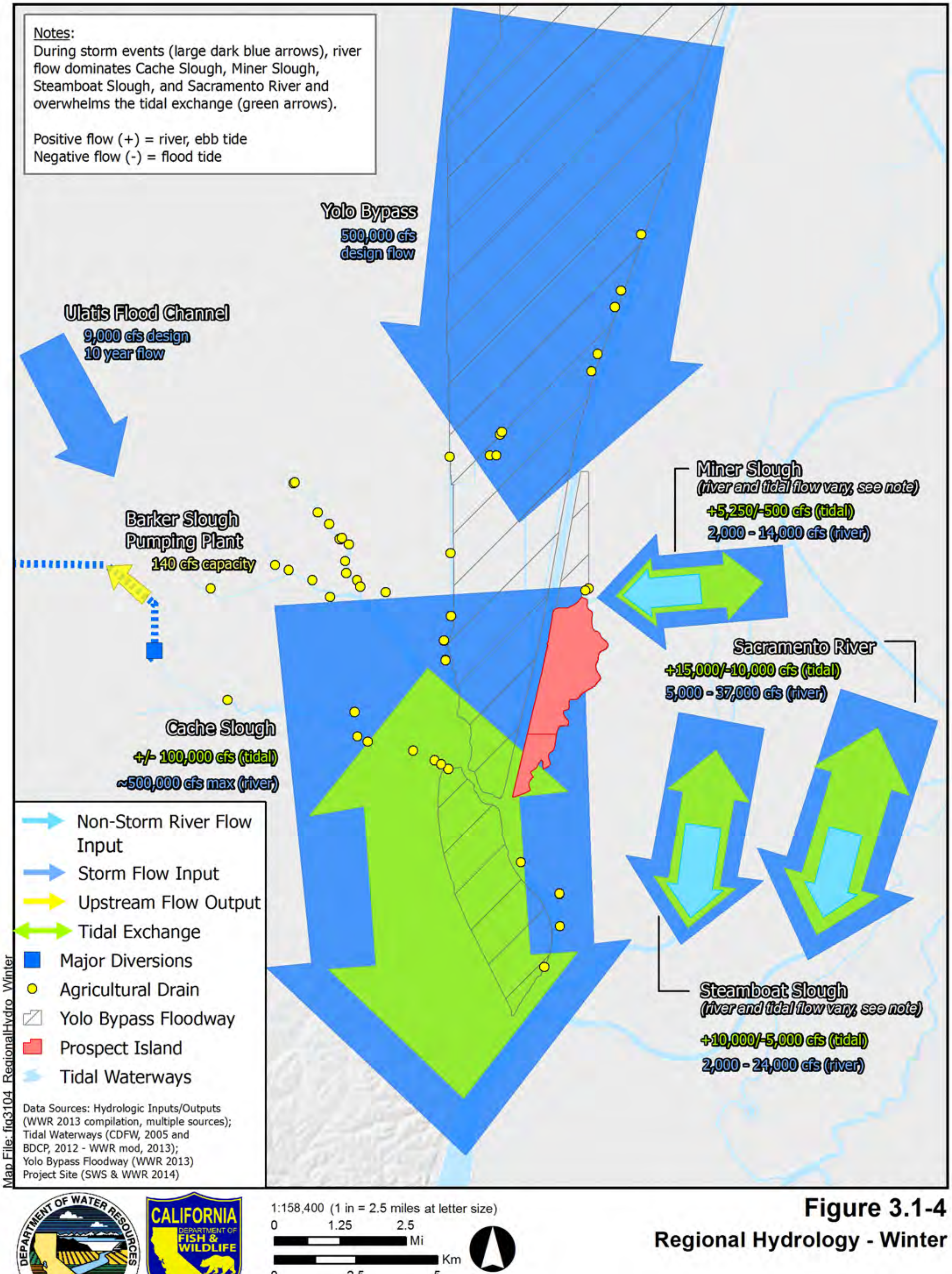


Figure 3.1-4
Regional Hydrology - Winter

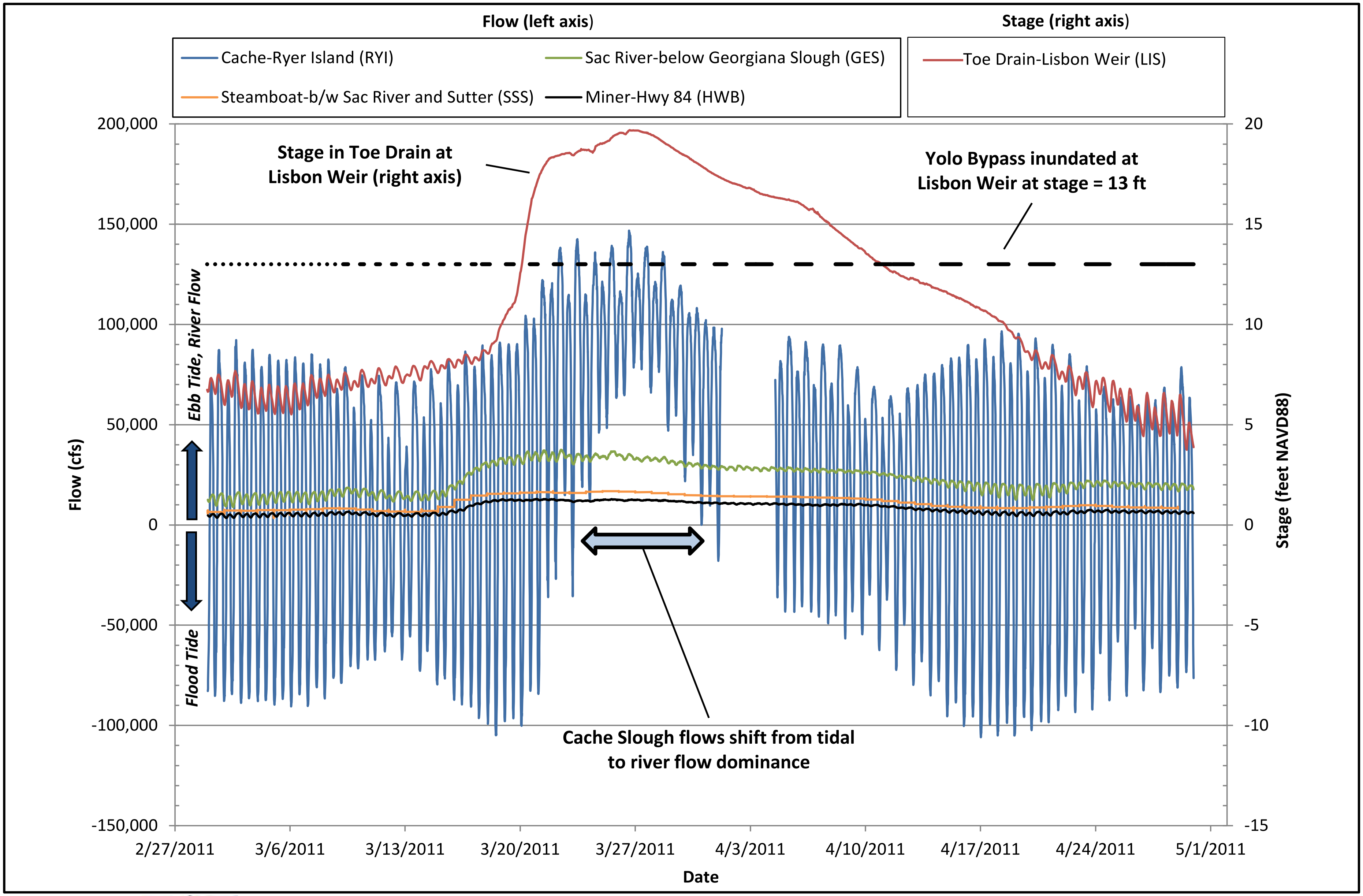
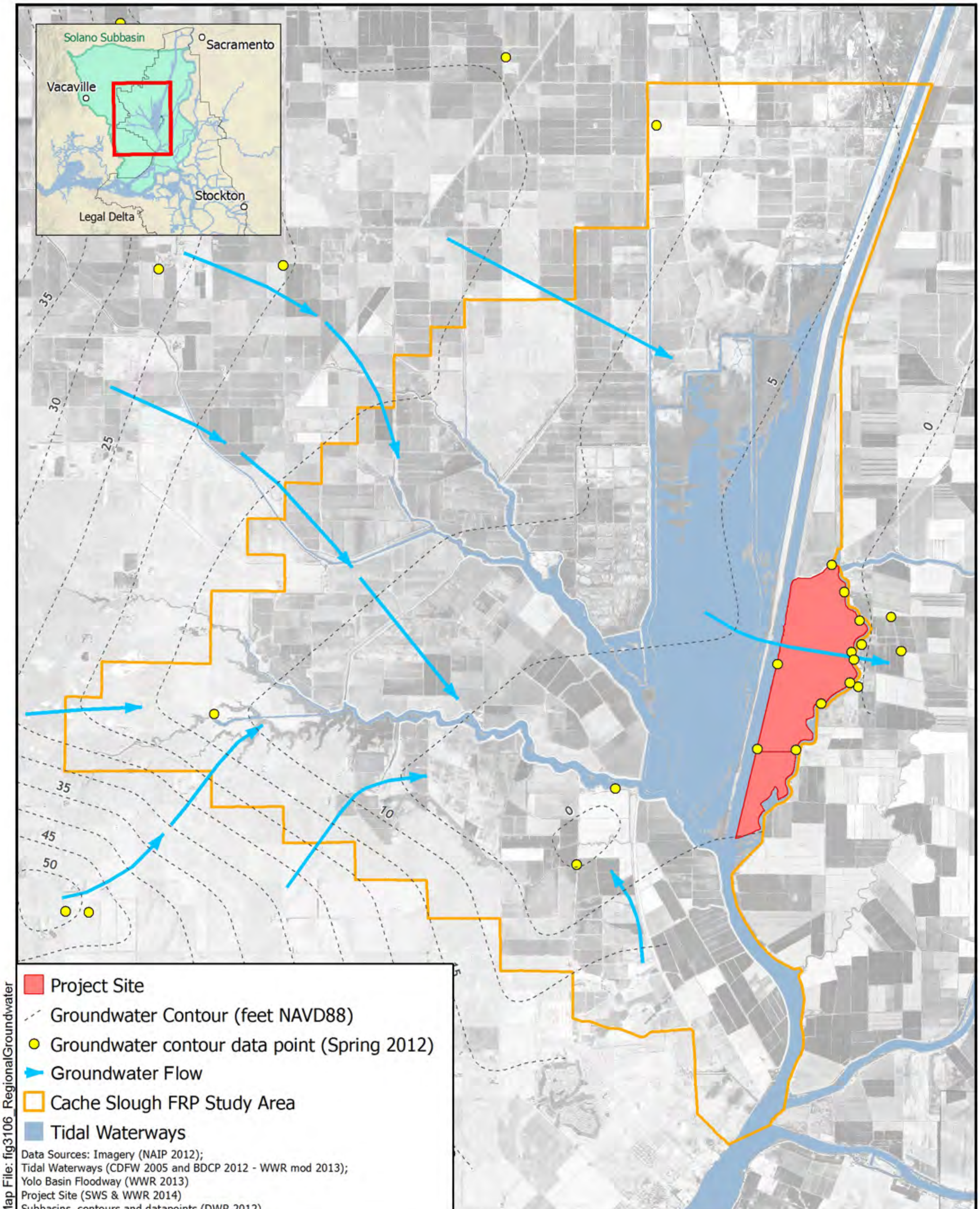


Figure 3.1-5
Comparison of Regional Flow Changes during March 2011 Storm Event

Regional groundwater

Prospect Island is situated within the southeastern portion of the Solano Subbasin of the Sacramento Valley Groundwater Basin (Basin Number 5-21.66) (DWR 2003; Figure 3.1-6). Primary waterways in and bordering the subbasin include the Sacramento, Mokelumne and San Joaquin Rivers, the DWSC, and Putah Creek. Groundwater levels were measured in 1912 at what are now considered to be natural, predevelopment levels by the USGS (Bryan 1923). At that time, the general direction of groundwater flow in the subbasin was from northwest to southeast. Currently, the regional groundwater flow gradient is from west to east toward the lower elevations of the central Delta; however, local drainage system operations on adjacent islands modify this gradient and increase the gradient from the surrounding sloughs to the island interiors (DWR 2003). During the spring of 2012, regional groundwater levels in the vicinity of the Project site were between 5 and -5 ft (NAVD88) and groundwater flow was generally from the northwest to the southeast similar to predevelopment conditions.



1:118,120 (1 in = 1.9 miles at letter size)

0 1 2 Miles

0 1 2 3 Kilometers

Figure 3.1-6

Groundwater Elevation Contour Map for a Portion of the Solano Subbasin, Spring 2012

Prospect Island area hydrology

As with regional conditions, local hydrologic conditions in the vicinity of Prospect Island are influenced by tides, flood conveyance, and water supply operations. Surface water/groundwater interactions also are important at the local scale, as described below.

Tidal datums

Tidal datums in the vicinity of Prospect Island are presented in Table 3.1-1. The datums were estimated considering 19 years of record at the Sacramento River at Rio Vista Bridge tide gage in the Delta and using those values, adjusted for the Prospect Island site (USACE and DWR 2001). These ranges are similar to tidal elevation range of 2.13 ft to 6.39 ft (NAVD88, MLLW to MHHW, respectively) established for the surrounding Cache Slough Region (from Table 4 of Appendix 3B in DWR 2013b).

Table 3.1-1. Tidal Datums in the Vicinity of Prospect Island

Tidal Datum	Elevation (feet NAVD88)
Mean Higher High Water (MHHW)	6.5
Mean High Water (MHW)	5.9
Mean Tide Level (MTL)	4.4
Mean Low Water (MLW)	2.6
Mean Lower Low Water (MLLW)	2.1

Source: USACE and DWR (2001)

Agricultural and municipal diversions and drains

There are numerous agricultural diversions along Miner and Cache sloughs in the vicinity of Prospect Island (Figure 3.1-2). These diversions are a mix of gravity siphons and pumps, varying in size from less than 15 inches to greater than 30 inches in diameter (A. Rabidoux, pers. comm., June 2013). There are also several agricultural drains along Miner and Cache sloughs proximal to the Project site.

Surface water

Surface water on Prospect Island originates from four sources: rainfall, Miner Slough, DWSC, and groundwater seepage. Average annual rainfall in the CSC is approximately 20 in, with most precipitation occurring during the rainy season, primarily between November and March. Some additional surface water originates from ground fog, known regionally as tule fog, during late fall and winter after the first significant rainfall, when atmospheric inversions generate fog.

Since the cessation of agricultural uses on Prospect Island, the two main properties on the island have had somewhat different hydrologic conditions. On the north property, water has entered from Miner Slough via a 4-ft diameter culvert, 50–75 ft in length, located in the southeast corner of the property. This culvert had a flap gate to prevent inflowing tidal waters, but unknown parties removed it not long after the 2008 levee breach repair, resulting in the property being inundated. DWR repaired and reinstalled the flap gate in December 2013.

The south property receives water from Miner Slough via seepage through the large rocks of the levee breach repair on the side channel to Miner Slough. Much of the south property is submerged. The south property experiences limited tidal exchange, but no water-level measurements have occurred to date to establish the magnitude of this tidal exchange.

Groundwater

Prospect Island

DWR completed a comprehensive, multi-year hydrogeologic study in the vicinity of Prospect Island (DWR 2014b). The study found that groundwater levels on Prospect Island vary daily and seasonally. From December 2011 to October 2013, groundwater elevations on Prospect Island ranged from 8.2 ft to -1.4 ft NAVD88 (DWR 2014b).

The DWR 2014 study also indicates that two primary hydrogeologic units (HU) are present in the vicinity of Prospect Island, including the Upper Clay HU and the Main Sand HU (DWR 2014b). Based on lithology, bathymetry, bed sediment samples, and hydrograph data, it appears that the channel bottoms of Miner Slough and DWSC are physically and hydraulically connected to the Main Sand HU. Due to the permeable nature of sandy soils, the intersections of the Miner Slough channel bottom and the Main Sand HU provide pathways for surface water to flow into the groundwater system. In contrast, lithology, geology and geomorphic maps, and trench logs indicate that surface water on Prospect Island is not connected to the Main Sand HU due to a low-permeability clay layer (Upper Clay HU) underlying Prospect Island that is 25-ft thick on average and separates surface water from groundwater flows (DWR 2014b). Overall, groundwater contour maps for the summer and winter 2012 periods indicate that Miner Slough is the dominant hydrologic feature controlling groundwater flow within the Proposed Project area (DWR 2014b).

The south property was not included as part of the original groundwater study area. Accordingly, groundwater conditions on this portion of Prospect Island can only be inferred from those in the general vicinity.

Ryer Island

Groundwater levels on nearby Ryer Island are significantly influenced by local precipitation and stage in Miner Slough (DWR 2014b). From December 2011 to October 2013, groundwater elevations on Ryer Island ranged from 0.67 feet to -6.71 feet NAVD88. Multiple seepage areas potentially under the influence of surface water on Prospect Island have been reported on Ryer Island by RD 501 and landowners (Figure 3.1-7).

The 2014 DWR study indicates that surface water from Miner Slough enters the Main Sand HU and flows east beneath and to the surface of Ryer Island. During the winter and early spring, groundwater levels on Ryer Island are close to or above the ground surface. These conditions coincide with precipitation events, stage increases in Miner Slough, and potentially the seasonal change in drainage system operation. This is significant because when groundwater levels in the shallow aquifer system rise to within a foot or less from the ground surface on Ryer Island, agricultural activities may be affected due to the saturation of shallow-depth, clay-rich soils. Also, when groundwater levels in the shallow aquifer system rise above the ground surface, groundwater seepage occurs. Furthermore, when the shallow groundwater levels are close to or above the ground surface, any precipitation that occurs can result in ponding.

During the spring and summer, the groundwater levels on Ryer Island decrease up to several feet; this is likely due to the operation of the Ryer Island drainage system, which lowers shallow groundwater levels in order to create a seasonal unsaturated zone to grow crops. Additionally, groundwater levels in many Ryer Island monitoring wells show small increases during the spring and summer, which are likely caused by irrigation activities.

Overall, groundwater levels, and to a limited extent drainage ditch stage, on Ryer Island appear to correspond to Miner Slough stage. There are also fluctuations in drainage ditch stage that do not correspond to groundwater level changes, and these are likely caused by irrigation activities on Ryer Island.

Groundwater elevation contours mapped as part of the 2014 DWR study indicate that Miner Slough is the dominant hydrologic feature in the Proposed Project area. In addition, Ryer Island groundwater levels follow a tidal pattern similar to

Miner Slough as well as respond to precipitation events and drainage and irrigation cycles. Therefore, there does not appear to be a significant relationship between the stage on Prospect Island and the groundwater levels on Ryer Island.

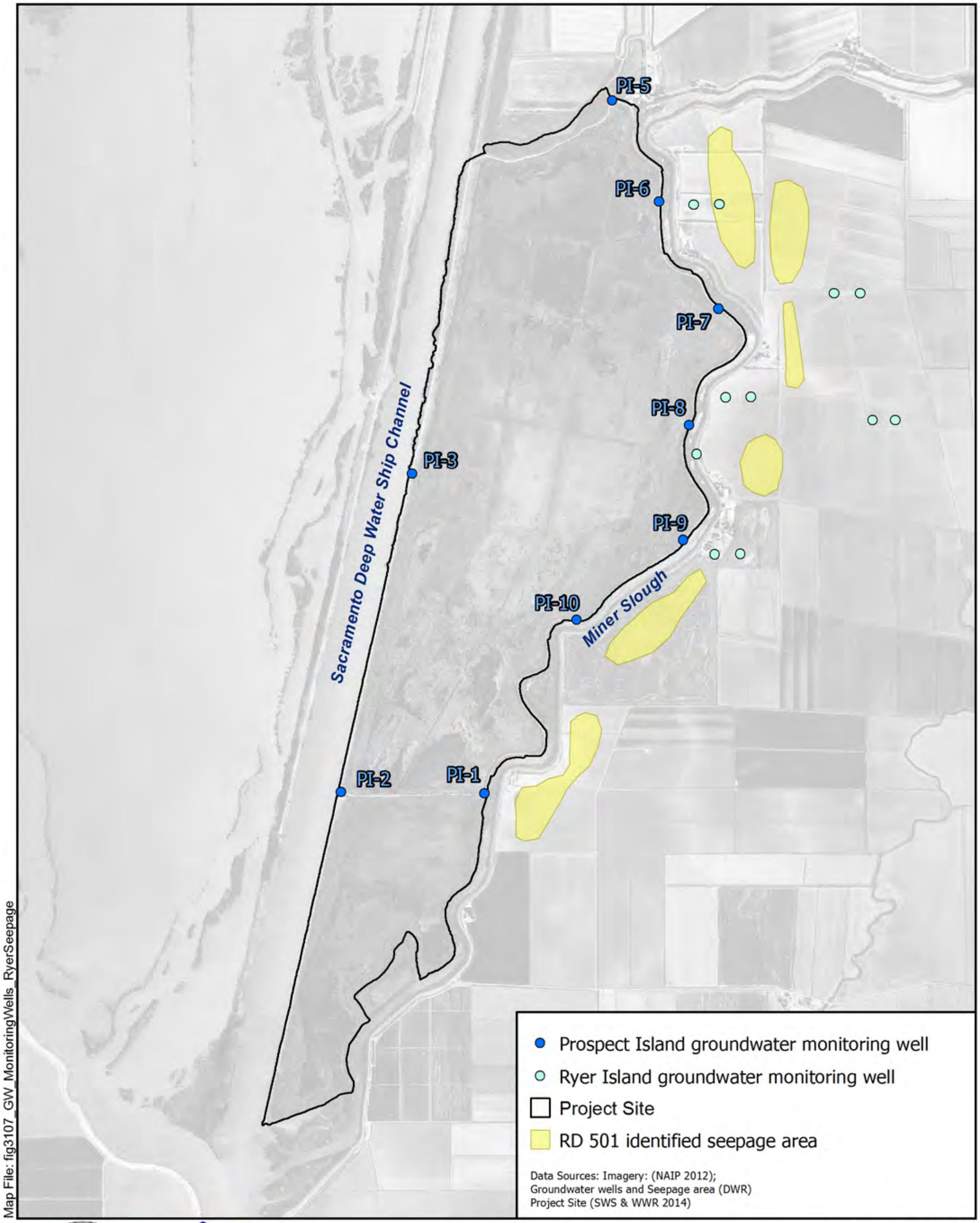


Figure 3.1-7
Prospect Island Groundwater Monitoring Wells and Ryer Island Seepage Areas

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Legal and regulatory setting

Federal laws

Unless otherwise noted, the Proposed Project would comply with the following federal laws.

Rivers and Harbors Act of 1899

The Rivers and Harbors Act of 1899 regulates the quality and hydrology of navigable waters and their tributaries through permitting administered by the USACE. Pursuant to this Act, any discharge of refuse matter into navigable waters and/or their tributaries without a permit is prohibited. Additionally, the Rivers and Harbors Act requires a permit to excavate, fill, or alter the condition, or capacity of any navigable water or federal levee. The Proposed Project would involve work within navigable waters of the US; thus the Proposed Project would be subject to applicable regulations as set forth by the Rivers and Harbors Act.

Clean Water Act

Alterations that may impact the hydrology or affect the surface and groundwater quality on the Project site or in receiving waters are subject to regulation by the Federal CWA, and to requirements established by the USEPA and the USACE. The CWA is described in detail in Section 3.2 Water Quality.

State regulations

Unless otherwise noted, the Proposed Project would comply with the following state regulations.

Reclamation Districts

The Project site is located on Reclamation District 1667 and borders Reclamation Districts 501 and 999. Notification of these neighboring Reclamation Districts is required as part of the CVFPB permit process, as described below.

Central Valley Flood Protection Board

Pursuant to CCR Title 23 Water Code, the CVFPB is responsible for enforcing standards for construction, maintenance, and protection of adopted flood control plans within the Central Valley of California, including the Yolo Bypass. Proposed restoration and levee work within the Proposed Project area would require an encroachment permit from the CVFPB.

An encroachment permit from the CVFPB is required for any project or plan of work that: (1) is within federal flood control project levees and within a CVFPB easement; (2) may have an effect on the flood control functions of project levees;

(3) is within a CVFPB designated floodway; or (4) is within the regulated Central Valley streams listed in Table 8.1 of 23 CCR.

23 CCR 107 provides for uses that may be permitted in a designated floodway, provided they would not unduly impede the free flow of water in the floodway or jeopardize public safety. Some of these uses that may apply to Proposed Project activities include: (a) open space uses not requiring a closed building, such as agricultural croplands, orchards, livestock feeding and grazing, or public and private recreation areas; (b) fences, fills, walls, or other appurtenances which do not create an obstruction or debris-catching obstacle to the passage of floodwaters; (f) improvements in stream channel alignment, cross-section, and capacity; and (i) other uses which are not appreciably damaged by floodwaters.

The standards that govern the design and construction of encroachments within CVFPB jurisdiction are provided in 23 CCR, Article A. The following sections provide standards that may apply to the activities associated with the Proposed Project.

- *23 CCR 112, Streams Regulated and Nonpermissible Work Periods*, prohibits banks, levees, and channels of floodways from being be excavated, cut, filled, obstructed, or left to remain excavated during the flood season for a given area. The flood season for the Yolo Bypass is November 1 through April 15. CVFPB may allow work to be done during the flood season provided forecasts for weather and river conditions are favorable.
- *23 CCR 115, Dredged, Spoil, and Waste Material*, prohibits dredged, spoil, or waste materials from being deposited on the levee crown, levee slope, or within the limits of a project floodway without specific prior approval from CVFPB. Approval is conditioned on the effect of the deposition on the flood-carrying capacity of the stream channel, floodway, or bypass; recreational and environmental factors; and fish and wildlife.
- *23 CCR 116, Borrow and Excavation Activities-Land and Channel*, authorizes the CVFPB to limit borrow and excavation activities within a floodway based on an area's hydraulics, hydrology, sediment transport, and history of the borrow sites. Borrow activities may be allowed if an activity would not cause an unplanned change of the stream's location; the sediment transport downstream would not change in a manner that produces or tends to produce increased flood or erosion problems in the area; and the activity is consistent with the overall flood control objectives for the area.

- *23 CCR 120, Levees*, mandates that levees constructed, reconstructed, raised, enlarged, or modified within a floodway must be designed and constructed in accordance with the USACE Manual, Design and Construction of Levees (USACE 2000).
- *23 CCR 131, Vegetation*, permits suitable vegetation, if properly maintained, within an adopted plan of flood control, provided it does not interfere with the maintenance, inspection, flood fight procedures or the overall integrity of that plan.
- *23 CCR 136* provides supplemental standards for the Yolo and Sutter bypasses. This section specifically notes that it is CVFPB policy to permit development of suitable wetlands within the Yolo Bypass. Other specifically relevant provisions of this section indicate planting of vegetation or the impoundment of water shall not be permitted in any area where there could be an adverse hydraulic impact; planting of vegetation is generally permitted for the development of native marsh, riparian vegetation, and wetlands; and no permanent berms or dikes are permitted above natural ground elevation without a detailed hydraulic analysis.

State Water Resources Control Board

Sacramento River flow at Rio Vista is identified as a water quality objective applicable to fish and wildlife beneficial uses (SWRCB 2006), with threshold levels for flow associated with these beneficial uses defined in Water Rights Decision D-1641 (SWRCB 2000). Table 3.1-2 below summarizes the minimum monthly flow requirements at Rio Vista. In addition, D-1641 requires that the 7-day running average not be less than 1000 cfs below the monthly objective.

Table 3.1-2. Rio Vista Minimum Monthly Flow Requirements

Month	Flow (cfs) by Water Year Type[1]					
	All	Wet	Above Normal	Below Normal	Dry	Critically Dry
September	3,000					
October		4,000	4,000	4,000	4,000	3,000
November–December		4,500	4,500	4,500	4,500	3,500

Source: (SWRCB 2006)

1 Sacramento Valley Water Year Hydrologic Classification (http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsihist)

Local ordinances and policies

The Solano County General Plan (Solano County Board of Supervisors 2008) contains ordinances and policies that pertain to hydrology. These ordinances and policies, listed below, deal with public health and safety as related to flood protection and management.

- HS.P-2: Restore and maintain the natural functions of riparian corridors and water channels throughout the county to reduce flooding, convey stormwater flows, and improve water quality.
- HS.P-8: Work with responsible parties to ensure dams, levees, and canals throughout the county are properly maintained and/or improved.
- HS.P-9: Preserve open space and agricultural areas that are subject to natural flooding and are not designated for future urban growth; prohibit permanent structures in a designated floodway where such structures could increase risks to human life or restrict the carrying capacity of the floodway.
- HS.P-10: Ensure that flood management policies that minimize loss of life and property also balance with environmental health considerations of the floodplain and therefore do not cause further erosion, sedimentation, or water quality problems in the floodplain area.

3.1.2 Significance criteria

Criteria for determining significant impacts are based upon Appendix G of the State CEQA Guidelines. In the evaluation that follows, a potential impact to hydrology was considered significant if the implementation of the Proposed Project would cause any of the following:

1. Substantial depletion of groundwater supplies or substantial interference with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
2. Substantial alteration of the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, to the extent that the rate or amount of surface runoff is altered in a manner that would result in flooding, erosion, or siltation on- or off-site.
3. Substantial alteration of agricultural water supply and drainage in the vicinity of the Project.
4. Creation or contribution to runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

5. Placement of structures within a 100-year flood hazard resulting in impedance or redirection of flood flows.
6. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.
7. Substantial groundwater seepage changes to adjacent properties.

Because groundwater would not be used under the Proposed Project, there would be no substantial depletion of groundwater supplies or interference with groundwater recharge and therefore, this potential impact is not considered further.

3.1.3 Impacts and mitigation

Impact 3.1-1: Potential changes in agricultural water supply and drainage due to changes in tidal range

The Proposed Project would increase the tidal prism of the Cache Slough Complex, and, in turn, reduce tidal range (MHHW-MLLW). The reductions to the heights of high tides and increases to the heights of low tides have the potential to both negatively and positively affect agricultural water management of both irrigation intakes and drains in the vicinity of Prospect Island. Depending on the location and the elevation of the associated farm field, intakes and drains operate by either gravity or powered pumps. For pumped agricultural supplies, an increase in MLLW would decrease the head that a pump would have to overcome to lift water onto the site during low tide, which would result in lower energy consumption and decreased costs (i.e., benefit). A decrease in MHHW would increase the head the pump would have to overcome to lift water onto the site during high tides, which would result in higher energy consumption and increased costs (i.e., negative impact). For intake siphons, an increase in MLLW would increase the duration and flow of water into the site (i.e., benefit) and a decrease in MHHW would decrease the duration and flow of water into the site (i.e., negative impact). Lastly, because underwater discharges are generally uncommon for agricultural drainage pumps, potential changes in tidal ranges would not be expected to affect pump operating conditions under the Proposed Project.

During the conceptual planning phase of the Proposed Project, a hydrodynamic model was used to calculate water level at fifteen representative locations throughout the Delta for a variety of project configurations with varying numbers and locations of breaches and weirs along Miner Slough (Figure 3.1-8) (Appendix

I in SWS and WWR 2012). These Phase 1 model results were similar between conceptual alternatives, regardless of number or location of breaches. The chosen analysis period (June 19–July 18, 2010) encompassed a strong neap-spring tide cycle; the type expected to be most affected by the Proposed Project. The model configuration most similar to the Proposed Project, Phase 1 “Alt 23”, exhibited slight increases in MLLW elevations mirrored by nearly equal decreases in MHHW elevations. Generally, tide range reductions varied under 1 inch up to 3 inches (Table 3.1-3). The only station that exhibited a greater change in tide range (6 inches) was Miner Slough at Highway 84 (HWB), located a short distance upstream of the northeast corner of Prospect Island (Figure 3.1-8). The effects on tidal range at HWB were not propagated further upstream, indicating a localized affect of the Proposed Project on tide range.

Table 3.1-3. Change in Summer, Strong Neap-Spring Tidal Range (MHHW-MLLW) from Base Conditions

Station Location	Station ID	Base Tide Range (feet)	Change in Tide Range Proposed Project (ft) (Phase 1 Alt 23)
Miner Slough at Highway 84 Bridge	HWB	3.25	-0.50
Steamboat Slough	SSS	2.83	-0.23
Sutter Slough at Courtland	SUT	2.52	-0.21
Sacramento River at Snodgrass Slough	B91750	2.39	-0.19
Yolo Bypass at Liberty Island	LIY	4.51	-0.18
Lindsey Slough at Hastings Bridge	LSHB	4.37	-0.17
Sacramento Deep Water Shipping Channel	DWS	4.33	-0.17
Sacramento River above Delta Cross Channel	SDC	2.96	-0.16
Cache Slough at Ryer Island	RYI	4.15	-0.16
Sacramento River at Freeport	FPT	1.86	-0.15
Sacramento River at Rio Vista	SRV	4.06	-0.11
South Fork Mokelumne River at New Hope Bridge	B94150	3.22	-0.09
Threemile Slough	TSL	3.71	-0.04
San Joaquin at San Andres Landing	B95100	3.53	-0.02
San Joaquin at Antioch	ANH	4.20	-0.02

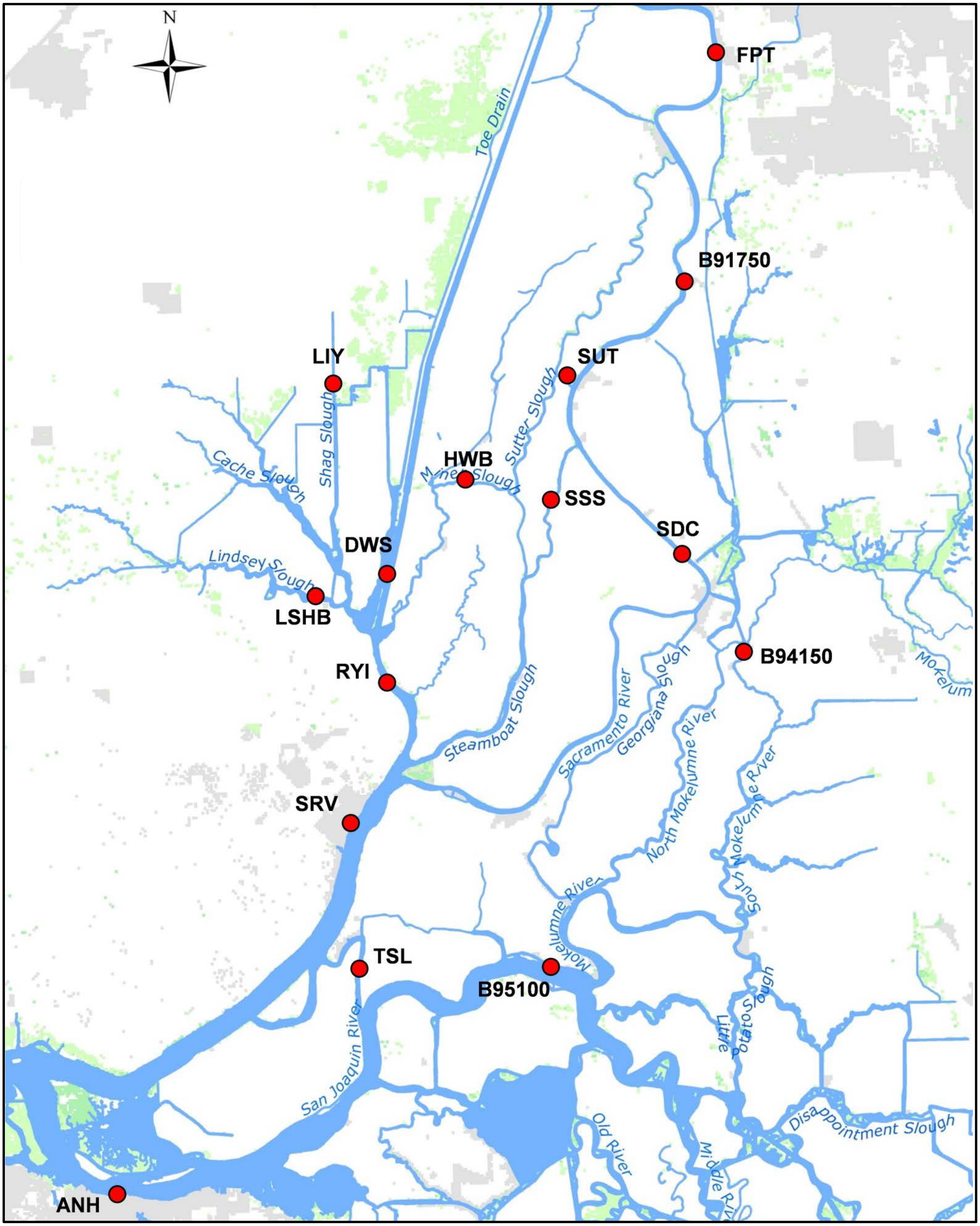


Figure 3.1-8

Hydrodynamic Model Tide Station Locations

Quantification of the potential effects of the Proposed Project on pipeline hydraulics of agricultural water operations would require pipe sizes, intake and outlet elevations, and design specifications at each potentially affected location. These data are not readily available for the numerous intakes in the Proposed Project vicinity. A maximum change in tide range of up to 0.5 ft was modeled immediately upstream of the Proposed Project, and this change would result in small but offsetting benefits and negative impacts for local agricultural water supply over the course of a complete tidal cycle. As discussed above, there would be no effect upon agricultural drainage operations. Overall, the effects would be less than significant.

Impact significance

Less than significant

Impact 3.1-2: Potential impacts to Sacramento River Flood Control Project and Yolo Bypass Floodway flood conveyance

Prospect Island is located within the Yolo Bypass and adjacent to lands protected by levees that are part of the SRFCP. Restoration of Prospect Island would result in new conveyance paths for flood flow via breaches along the Prospect Island Miner Slough restricted height levee. Changes in these paths could result in changes in flow splits in various locations in the lower portions of the SRFCP, which in turn could increase water levels within the Yolo Bypass Floodway and along channels and sloughs protected by SRFCP levees relative to existing conditions. Formal numerical guidance on allowable increases in flood elevation is not available from the Central Valley Flood Protection Board and by default rely upon a zero rise or flood neutral standard. However, due to inherent modeling uncertainties, projected increases in stage of up to 0.1 ft along SRFCP levees have been acceptable in other studies (Appendix H in SWS and WWR 2012).

Potential impacts to flood conveyance within the Yolo Bypass and along Miner Slough, Sutter Slough, Steamboat Slough, and the Sacramento River from Rio Vista to Freeport were evaluated using a hydraulic model developed by the USACE based on the RMA2 platform (USACE 2007). Fifteen conceptual alternatives, one of which was similar to the Proposed Project, were modeled and compared to the baseline flow and water surface elevation conditions under 1957 SRFCP design flow conditions (Appendix H in SWS and WWR 2012). The modeled conceptual alternatives included a variety of configurations with varying numbers and locations of breaches along both Miner Slough and the DWSC. None of the conceptual planning alternatives correspond exactly with the

Proposed Project with respect to location of breaches along Miner Slough; configuration, location or size of internal channels; size of the internal cross levee breach; placement of fill to create the intertidal bench; nor placement of fill to create the toe berm.

Collectively, alterations to the topography and vegetation interior to Prospect Island and breaches to the levees around Prospect Island, as defined under the various conceptual alternatives, would not have flood conveyance impacts to the Yolo Bypass or to the rivers and sloughs protected by the SRFCP. Miner Slough, Sutter Slough, and Steamboat Slough exhibited small increases (less than 1%) and the Sacramento River exhibited small decreases (less than 1%) in flow across all alternatives. These modeled flow changes resulted in very small localized changes in water surface elevations (less than 0.05 ft) near the DWSC and internal to Prospect Island, none of which were adjacent to SRFCP levees. Modeled changes in flow and water surface elevation were within the range of model uncertainty and therefore considered insignificant (Appendix H in SWS and WWR 2012). The fact that the modeling results were similar across alternatives with a variety of configurations implies that similar results would occur for the Proposed Project.

Impact significance

No impact

Impact 3.1-3: Groundwater seepage impacts from Prospect Island to adjacent areas

The Proposed Project has the potential to cause an increase in groundwater seepage on Ryer Island which may affect agricultural land uses. Multiple seepage areas potentially under the influence of surface water on Prospect Island have been identified by RD 501 (Figure 3.1-7). To evaluate this possible impact, DWR completed a multi-year Site Characterization and Groundwater Monitoring Study (DWR 2014b). As part of the study, two-dimensional, finite element models along three Prospect Island - Ryer Island transects were used to analyze seepage conditions. This modeling approach was chosen as it considered the major elements of the subsurface hydrogeology along each transect. The models were created to analyze seepage conditions along transects that cross the levees and sloughs in the Proposed Project area and were developed to model average and high Miner Slough stage, and subsurface conditions. Two seepage-model scenarios were evaluated under two different stage conditions to determine if there may be any impacts to adjacent areas due to the Proposed Project:

- Existing Conditions Scenario (Flooded Prospect Island—No levee breach)
  - Average and high Miner Slough stage during the period of record
- Restored Conditions Scenario (Flooded Prospect Island—Levee breached and connected to Miner Slough)
  - Average and high Miner Slough stage during the period of record

Surface water stage and groundwater levels vary significantly on a daily (due to tides) and seasonal basis within the Proposed Project area. In order to evaluate potential impacts caused by the Proposed Project, both average and high-stage conditions were used. The high-stage conditions (that would result in maximum head and flow) were determined based on the highest stage of Miner Slough during the period of record in the DWR (2014b) study. The remaining model inputs were chosen at this same time interval or were approximated based on the best available data. The models developed for the seepage analysis were used to estimate hydraulic parameters that were considered critical for the evaluation of potential Proposed Project effects. Specific parameters include:

- The total head (in feet) in the Main Sand hydrogeologic unit (HU) underlying the Ryer Island levee
- The total groundwater flow through a vertical section, termed the seepage flux through the middle of the Ryer Island levee.

Total head and groundwater flow were considered to be important indicators of potential impacts detrimental to adjacent islands, as a significant rise in total head and/or groundwater flow may impact agricultural operations.

The seepage modeling results (DWR 2014b) indicate that; (1) the groundwater flow under the Ryer Island levee is directly related to the stage in Miner Slough, (2) the source of seepage on Ryer Island is from Miner Slough and seepage flow increases with higher Miner Slough stage, and (3) regardless of the model scenario (existing flooded or restored flooded) on Prospect Island or Miner Slough conditions (average or high stage), the total head and groundwater flow under the Ryer Island levee show little to no change. Therefore, the Proposed Project is not expected to have any substantial seepage effects on Ryer Island. Additionally, DWR would continue groundwater and surface water monitoring during and after implementation of the Proposed Project, which would allow for assessment of conditions following restoration.

Impact significance

Less than significant

Impact 3.1-4: Potential wind-wave erosion of the interior side of Prospect Island levees

The Proposed Project would expose the interior side of the Miner Slough levee on Prospect Island to wind-generated waves. This could lead to erosion and affect the integrity of this levee over time, which may lead to subsequent erosion impacts on the SRFCP levee along Ryer Island. While wind-wave erosion depends on several factors (e.g., levee bank conditions, levee geometry), the dissipation of wave energy over time is considered a primary contributor (URS et al. 2006). Wind-wave energy often varies seasonally with wind speed and direction. In the Proposed Project vicinity, average wind speeds during the spring and summer months are generally greater and more constant, directed strongly from the west-southwest (BAAQMD 2014). In fall and winter, wind direction is more variable and average wind speeds are significantly lower. As the length of open water across which wind can blow uninterrupted (i.e., fetch) increases, so does wind-wave energy. As measured in the predominant west-southwest wind direction, maximum fetch for the Proposed Project would be approximately 2 miles.

During the conceptual planning phase of the Proposed Project, wave properties within Prospect Island for the months of October–December were modeled to analyze potential erosion and transport of bottom sediments for seven restoration alternatives (Appendix C in WWR and SWS 2014). The modeled conceptual alternatives included a variety of configurations with varying numbers and locations of breaches and weirs along Miner Slough along with internal design features (e.g., channel network, vegetation extent, eastern berm and intertidal bench). Overall, the modeling predicted relatively low significant wave heights (<0.8 ft) and wave periods (<2 seconds) for wind speeds ranging from approximately 0 to 25 MPH. Wave heights and periods were significantly reduced within shallow, vegetated areas due to wave damping effects, especially during periods of stronger winds. Although wind-wave properties were not modeled during the more energetic spring and summer months, Proposed Project elements such as the intertidal bench and toe berm on the Miner Slough levee would serve to dissipate wave energy. In addition, routine monitoring of the Miner Slough levee by DWR would continue under the Proposed Project, and any damage with the potential to impact public safety would be repaired. Overall, this would be a less than significant impact.

<u>Impact significance</u>

Less than significant

Impact 3.1-5: Potential toe-scour and erosion of Miner Slough levees affecting Ryer Island levee stability

As discussed under the environmental setting section and under Impact 3.1-2 above, the Prospect Island levees provide flood protection functions under the SRFCP and are part of the Yolo Bypass Floodway. The adjacent Ryer Island Miner Slough levee also provides flood protection to Ryer Island under the SRFCP.

Breaching the levees on the Miner Slough side of Prospect Island would lead to both increased velocities in Miner Slough by increasing the tidal prism and could also create localized cross-currents at the breach locations towards Ryer Island. Both of these changes have the potential to erode the Miner Slough levee and thereby threaten the long term stability of the flood protection provided. To determine the potential for scour, Phase 1 hydrodynamic modeling was conducted for a variety of conceptual alternatives (Appendix K in SWS and WWR 2012). Modeling results were used to calculate in-channel and breach exit velocities and directions for two flow conditions: (1) a strong neap-spring tide cycle during summer, which was expected to generate maximum velocities during periods not influenced by storm flows in Miner Slough; and (2) high North Delta inflow conditions occurring during winter which represent periods when Miner Slough carries storm flows. The modeling was completed during the Prospect Island habitat restoration conceptual planning phase, and as such the configurations of the modeled alternatives with respect to the number and location of breaches do not correspond exactly to the Proposed Project. However, since modeling results were similar between conceptual alternatives, regardless of number or location of breaches, it is anticipated that later refinement of the designs for the Proposed Project (Section 1.1 Overview of the Project) would not alter the modeled outcomes. The Phase 1 model configuration most similar to the Proposed Project is “Alt 23.”

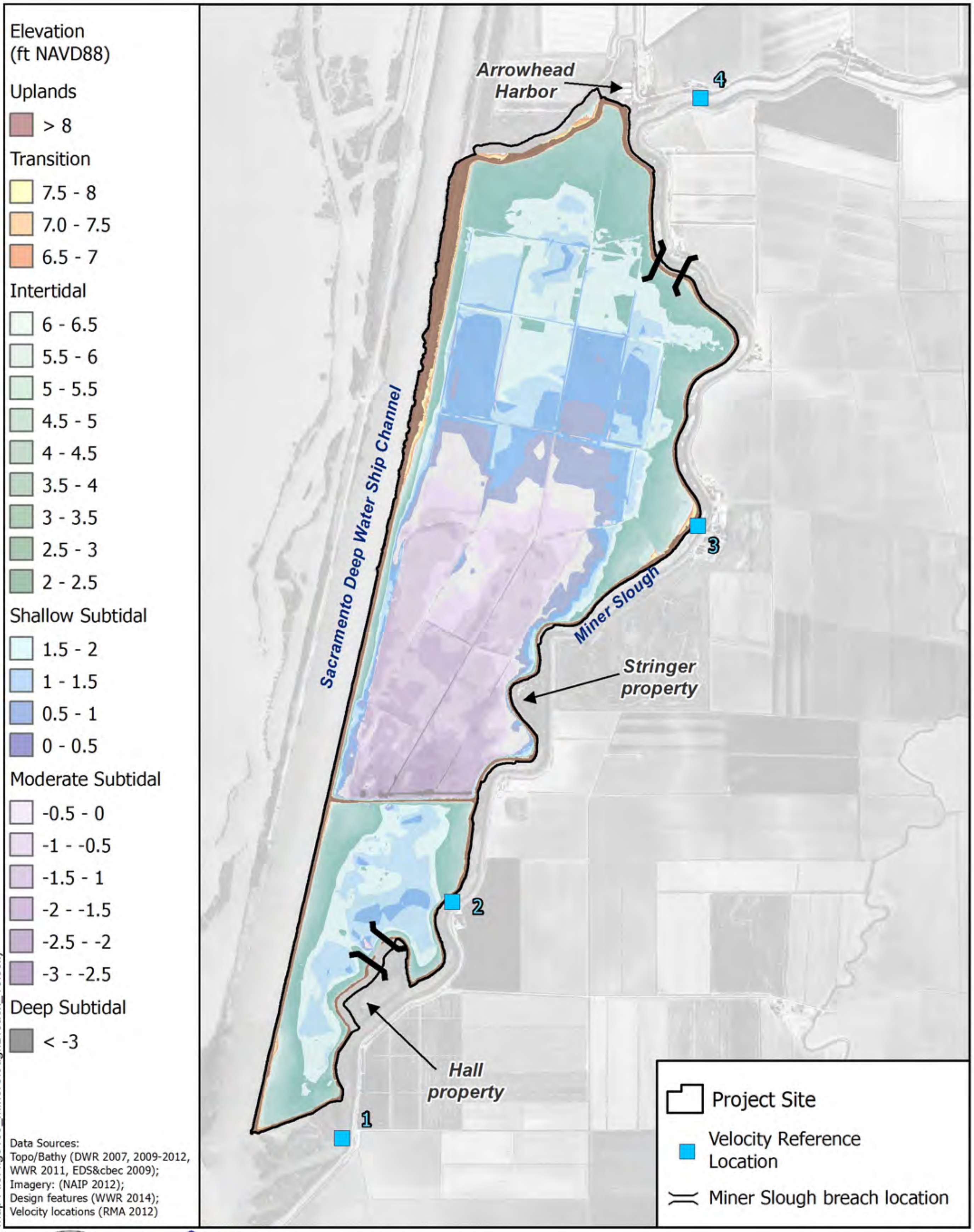
Potential for cross-currents to impact the Ryer Island levee

Model results indicate flow leaving Prospect Island through the levee breaches would converge rapidly with the primary Miner Slough flow path. Cross-current flows would not reach or impact the Ryer Island side of the Miner Slough levee and therefore would not have the potential to scour the levee (Appendix K in SWS and WWR 2012).

Potential for bed scour to impact the Ryer Island levee

Under existing conditions, the banks of Miner Slough are heavily vegetated with some rock rip-rap slope protection. Channel-bed grain-size data have not been collected or analyzed, however it can be assumed that the channel bed is mostly composed of fine-grained materials. Per Fischenich (2001), stability thresholds for fine bed materials are assumed to range from 2–4 ft/sec. These thresholds increase to a range of 4–6 ft/sec when native vegetation is present and 5–18 ft/sec when rip-rap is used (depending on rock diameter size). Modeled results indicate the Proposed Project may increase channel velocities downstream of breach locations and decrease channel velocities upstream of breach locations relative to baseline conditions (Table 3.1-4, Figure 3.1-10, Figure 3.1-11). During summer low flow and winter high flow baseline conditions, cross-sectionally averaged longitudinal velocities in Miner Slough ranged from 1.6 to 3.9 ft/sec, which are within the identified stability thresholds. However, during high flow winter conditions, modeled results indicate that cross-sectionally averaged velocities under the Proposed Project would range 1.5 to 5.2 ft/sec, slightly in excess of the identified stability thresholds (Table 3.1-4).

Recognizing that water velocities are lower along the channel bed and channel margins, modeled spot velocities under both the low and high flow scenarios rose above the fine-grained scour threshold (4 ft/s) in some locations with the highest velocities occurring near the center of the channel cross-section (Figure 3.1-10 and Figure 3.1-11). This indicates the potential for scour along the channel bottom during winter conditions under both baseline conditions and the Proposed Project. Although channel bed scour has the potential to erode the toe of the Miner Slough levees, modeled velocities near the banks remain below stability thresholds for fine-grained materials and well below those for vegetated and rip-rap protected areas under both low and high flow scenarios (Figure 3.1-10 and Figure 3.1-11). Further, the Ryer Island Miner Slough levee would continue to be monitored under the Proposed Project and any repairs for damage caused by the Proposed Project would be conducted or funded by DWR. Therefore, this would be a less than significant impact.



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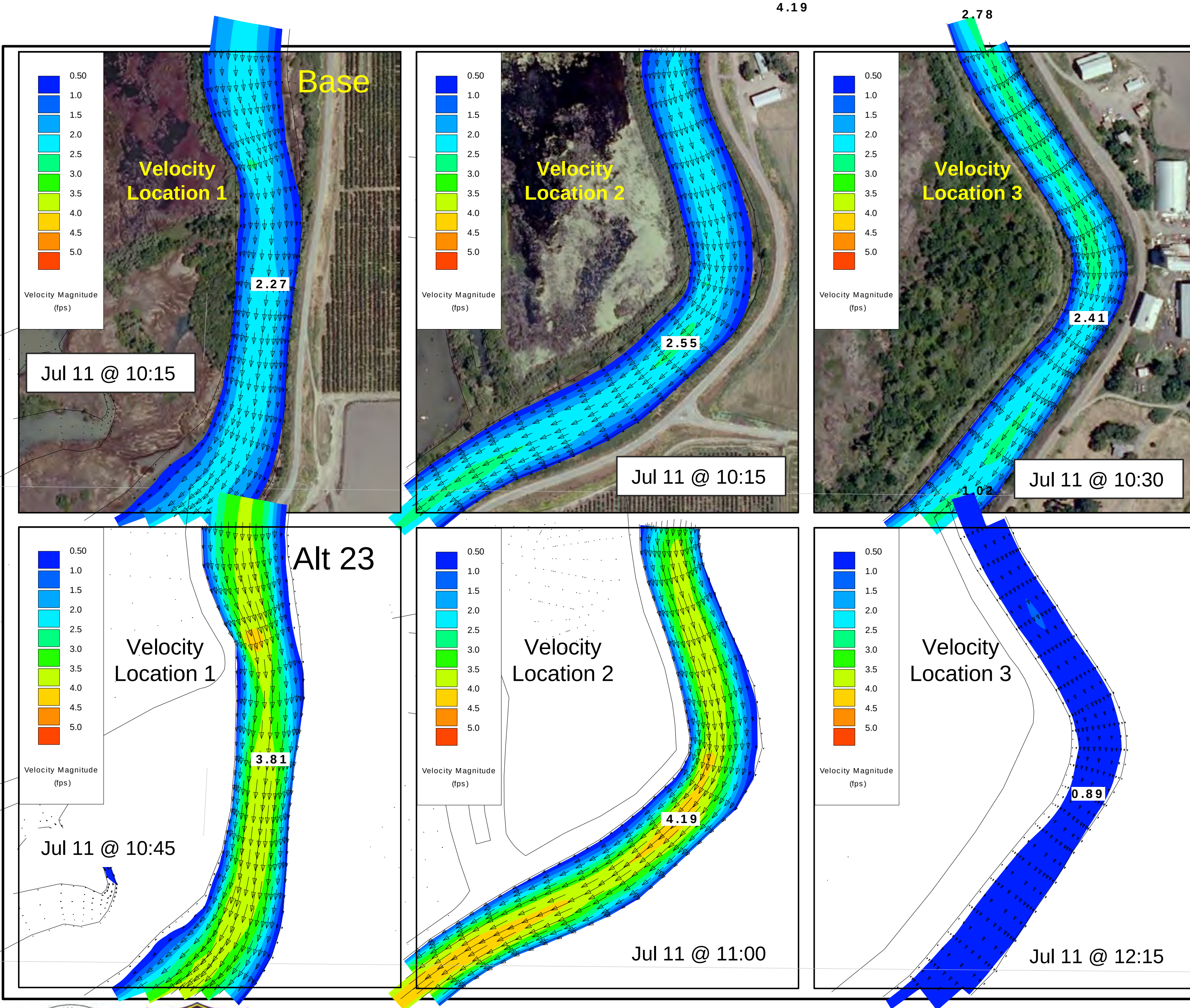
0 0.5 1 Km

Figure 3.1-9

Miner Slough Breach and Velocity Reference Locations

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT



Model peak ebb current velocities for Base (No Project) & Alt 23 condition, July 11, 2010 at the three velocity reference locations along Miner Slough.

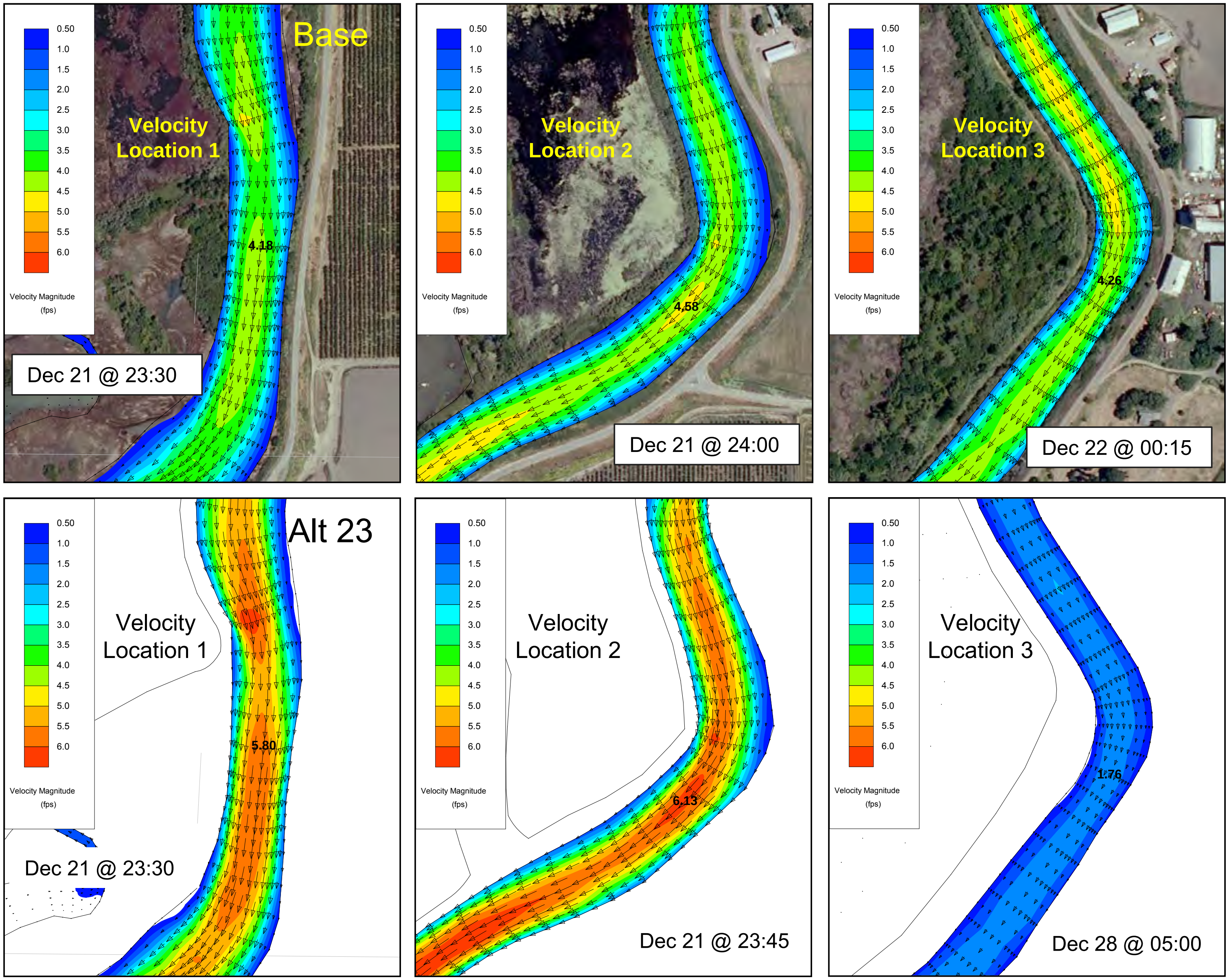
Spot velocity values are shown near the channel center.

Source: RMA 2012

Figure 3.1-10

Peak Ebb Current Velocities for Baseline and Alternative Similar to Proposed Project - Summer (Strong Neap-spring Conditions)

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT



Model peak ebb current velocities for Base (No Project) & Alt 23 condition, December 2010 at the three velocity reference locations along Miner Slough.

Spot velocity values are shown near the channel center.

Source: RMA 2012

File: Fig 3-20_Peak-Vel_Summer_EIR_AL_2014-0811gal

Figure 3.1-11

Peak Ebb Current Velocities for Baseline and Alternative Similar to Proposed Project - Winter (Storm Conditions)

Table 3.1-4. Modeled Velocities in Miner Slough by Flow Period for Baseline Conditions and Under the Proposed Project

Flow Period	Modeled Velocity Location	Peak Longitudinal Cross-section Averaged Velocity (ft/sec)	
		Baseline	Proposed Project (Phase 1 Alt 23)
Summer, strong neap-spring conditions	1	1.58	3.24
	2	1.76	3.58
	3	1.69	0.78
	4	1.64	1.33
Winter storm conditions	1	3.56	4.93
	2	3.9	5.21
	3	3.69	1.52
	4	3.29	3.97

Source: Appendix K in SWS and WWR (2012)

<u>Impact significance</u>

Less than significant

Impact 3.1-6: Potential increase in seepage on adjacent lands due to Miner Slough bed scour

Because hydraulic modeling suggests that the Proposed Project could potentially result in increased scour of Miner Slough bed sediments downstream of the southern levee breach (Appendix K in SWS and WWR 2012), the Proposed Project may potentially increase observed seepage at some locations on Ryer Island (Figure 3.1-7). The DWR hydrogeologic study (DWR 2014b) concluded that there is a significant hydraulic connection between the DWSC, Miner Slough, and the Main Sand HU underlying the Project area. Although portions of Miner Slough intersect this higher permeability Main Sand HU, the channel bottom primarily lies within the lower-permeability Upper Clay HU. Because potential bed scour would primarily expose additional fine-grained (i.e., clay and silt) materials within the Upper Clay HU, this scour would not be expected to significantly increase the area of hydrologic connection between the Main Sand HU and Miner Slough. Therefore, the Proposed Project is unlikely to significantly increase the existing surface water-groundwater connection; therefore, seepage impacts on adjacent areas due to increased Miner Slough bed scour are expected to be less than significant. Additionally, DWR would continue groundwater and surface water monitoring during implementation of the Proposed Project which would allow for assessment of conditions following restoration.

Impact significance
Less than significant

Impact 3.1-7: Potential impacts to regional flow resulting in non-compliance with D-1641 flow requirements on the Sacramento River at Rio Vista

Under existing conditions, flows are managed in the Delta to meet D-1641 minimum monthly average and 7-day running average flow requirements in the Sacramento River at Rio Vista. The Proposed Project would increase the tidal prism of the Cache Slough Complex, thereby increasing flows into and out of the region during flood and ebb tides.

Hydrodynamic modeling of regional flow patterns was conducted for twelve (12) selected conceptual restoration alternatives during Phase 2 modeling (Appendix D in WWR and SWS 2014). The modeled conceptual alternatives included a variety of configurations with varying numbers and locations of weirs and breaches along both Miner Slough and the DWSC. The model configuration most similar to the Proposed Project under Phase 2 modeling is “Alt 26.” Using existing Delta operational scenarios, model results predicted small increases in Sacramento River net outflow at Rio Vista for all modeled alternatives. The fact that the modeling results were the same across alternatives with a variety of configurations implies that similar results would occur for the Proposed Project. As the existing flows are already in compliance and the modeling predicted increases over the existing flows, it is not expected the Proposed Project would result in non-compliance with the monthly average D-1641 flow requirement. In addition, the modeling also predicted that increases in the 7-day running average, above the existing condition, indicating no potential for non-compliance relative to the existing condition. Based on these modeling results, the Proposed Project would not impact D-1641 compliance.

Impact significance
No impact

Impact 3.1-8: Potential scour impacting stability of nearby bridges, trestles, culverts or other structures

The major river-crossing structures in the vicinity of Prospect Island are the Highway 84 Bridge over Miner Slough (about 0.8 river miles upstream from the north end of Prospect Island), the Hastings Island bridge over Lindsey Slough (about 2 river miles upstream of the confluence of Cache Slough, the DWSC, and Miner Slough), and the Highway 84 ferry crossing between Rio Vista and Ryer Island (about 3 river miles downstream of the confluence of Cache Slough, the DWSC, and Miner Slough). Breaching the levees on the Miner Slough side of Prospect Island would increase flows in Miner Slough by increasing the tidal prism. As discussed under Impact 3.1-6, Phase 1 modeling completed during Prospect Island conceptual planning predicted the Proposed Project would increase channel velocity downstream of breach locations and decrease channel velocity upstream of breach locations (Appendix K in SWS and WWR 2012). No flow changes were predicted within Lindsey Slough. Thus, the Proposed Project would not increase scour at the Highway 84 Bridge or the Hastings Island Bridge.

Modeled Cache Slough flows downstream of Prospect Island are expected to slightly increase to accommodate the increased tidal prism. However, the increased flow (2,500 to 5,000 cfs) is insignificant compared to the approximately 100,000 cfs tidal exchange that occurs in Cache Slough on a daily basis (Figure 3.1-3 and Figure 3.1-4). Therefore, any velocity increases associated with the flow increases are expected to have no impact on the stability of the Highway 84 ferry crossing.

Impact significance

No impact

Impact 3.1-9: Potential impacts to water rights from diversion of surface water

Breaching the Prospect Island Miner Slough levee would create tidal conditions within the island, with water flowing freely into both breach locations during flood tides and out of both breach locations during ebb tides. As such, the restored site would not behave as a true flow-through system possessing a dedicated inlet and outlet. For this reason the Proposed Project would not represent a diversion of water from Miner Slough into Prospect Island[1].

Compared with existing conditions, changes in consumptive water use under the Proposed Project would be due to changes in evaporative losses from open water areas and/or evapotranspiration (ET) losses from wetland and riparian areas within Prospect Island. In general, because evaporation from open water

[1] "Diversion" is defined as taking water by gravity or pumping from a surface stream or subterranean stream flowing through a known and definite channel, or other body of surface water, into a canal, pipeline, or other conduit, and includes impoundment of water in a reservoir (California Water Code Section 5100).

areas is lower than adjacent vegetated areas, including wetlands, the amounts of open water and vegetated habitats under the Proposed Project have direct bearing on projected ET losses. For example, a study to determine patterns of ET water loss from salt and tidal freshwater marshes in Chesapeake Bay indicated that tidal freshwater marsh ET losses were approximately 2.2 times greater than evaporative losses from nearby tidal freshwater open water areas (Hussey and Odum 1992).

Under the Proposed Project, freshwater wetland and riparian habitat (higher intrinsic ET rate) would decrease by approximately 76 ac (i.e., 48 ac of wetland plus 28 ac of riparian) and freshwater tidal open water habitat (lower intrinsic evaporation rate) would increase by approximately 122 ac (Table 2.2-2). The decrease in consumptive water use due to ET losses from wetland and riparian habitats under the Proposed Project would be expected to offset increases due to evaporative losses from open water habitat such that overall consumptive use would be generally similar to or less than existing conditions.

Overall, given the lack of water diversion and the anticipated lack of increase in consumptive water use due to ET losses, there would be no take of water for beneficial use as defined by the State Water Resources Control Board and therefore, no impact to existing downstream water rights under the Proposed Project.

Impact significance

No impact

Impact 3.1-10: Potential construction related impacts to groundwater supplies and third party wells

Dewatering will be required during Project site preparation as well as during construction for a period of about two years. This dewatering will result in a temporary lowering of groundwater levels below the Project site. In the event that dewatering wells are employed for this purpose, the relatively low permeability of fine-grained materials (i.e., clay and silt) within the Upper Clay Hydrogeologic Unit underlying the Project site (DWR 2014b) are expected to limit the radius of influence to a short distance from these wells. Therefore, potential groundwater extraction from the shallow subsurface of the Project site for dewatering purposes would not result in overdraft of local groundwater supplies nor would it impact the water levels or yield of any third party wells within the vicinity of Prospect Island.

Impact significance

No impact

3.2 Water Quality (Surface and Groundwater)

Water quality consists of physical, chemical, and biological characteristics of water. This section describes existing water quality conditions at the Project site and potential project-related impacts to water quality. It also reviews water quality plans and regulations pertinent to the Prospect Island area and describes mitigation measures to address potential impacts.

3.2.1 Setting

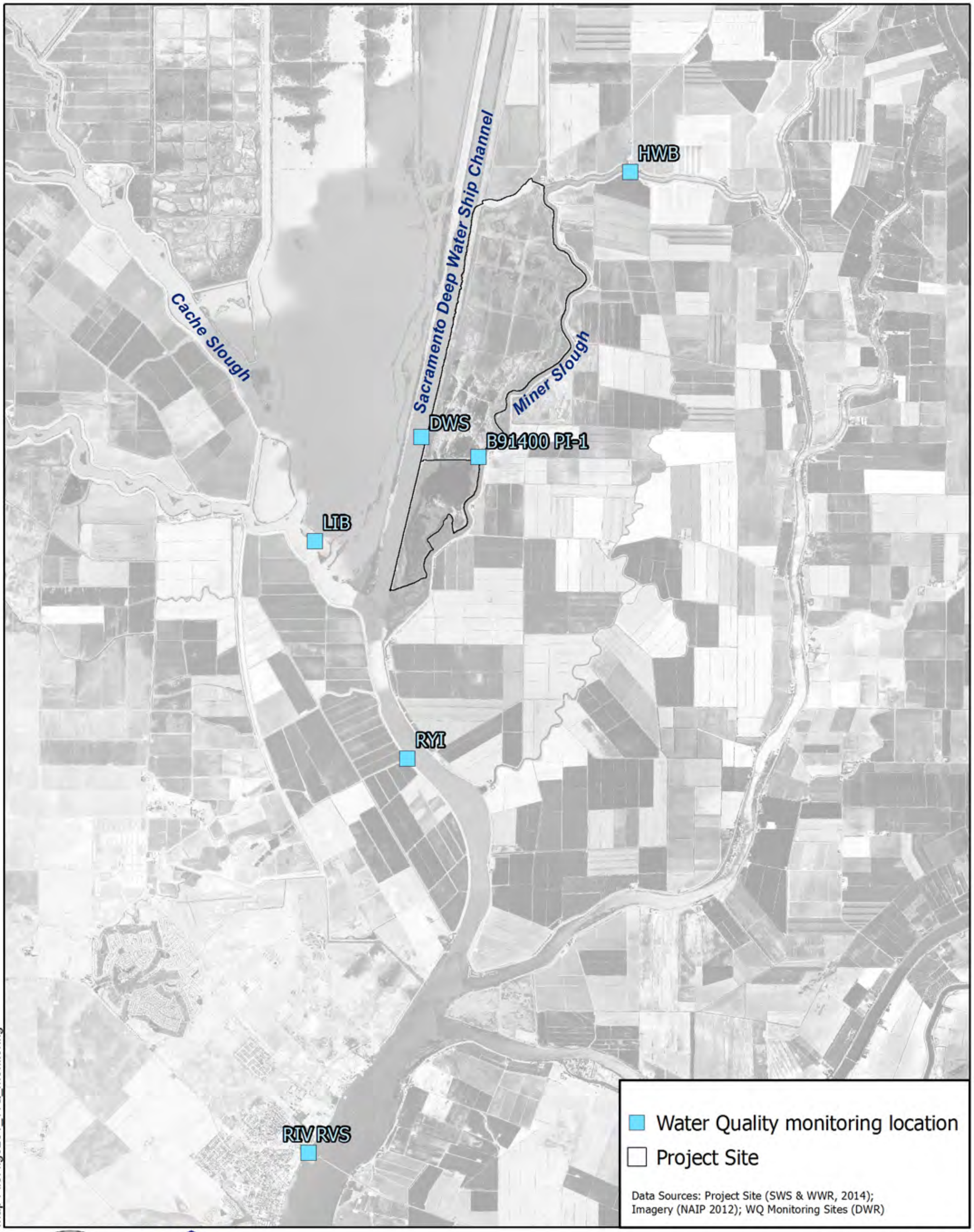
Environmental setting

Surface water on the Project site originates from precipitation, Miner Slough, the DWSC, and groundwater seepage (Section 3.1.1 Hydrology – Setting). *In situ* water temperature, dissolved oxygen, pH, electrical conductivity, turbidity, and chlorophyll have been continuously monitored (e.g., 15-minute intervals) by the USGS, USBR, and DWR in the Project site and in surrounding waterways (Table 3.2-1, Figure 3.2-1). Existing surface water and groundwater quality conditions are described in the sections that follow.

Table 3.2-1. Key Water Quality Monitoring Stations

Station Name (ID)	Latitude/ Longitude	Selected Parameters Monitored	Data Collected Since	Collected By
Prospect Island Tide Station 1 (B91400 PI-1)	38°15'12.30"N 121°39'24.90"W	water temperature	1/12/2011	DWR
Miner Slough At Hwy 84 Bridge (HWB)	38°17'30.12"N 121°37'50.88"W	electrical conductivity water temperature turbidity	12/02/2009	USGS
Sacramento Deep Water Ship Channel (DWS)	38°15'22.00"N 121°40'0.01"W		1/15/2011	
"Liberty Island @ Approx Cntr S End" (LIB)	38°14'31.56"N 121°41'5.64"W		12/20/2010	
Cache Slough At Ryer Island (RYI)	38°12'46.08"N 121°40'9.12"W		12/02/2009	
Sacramento River At Rio Vista Bridge (RVB) and Rio Vista (RIV)	38°9'35.05"N 121°41'10.88"W	electrical conductivity	1/01/1984	DWR and USBR
		water temperature	2/22/1999	
		turbidity	1/29/2008	
		chlorophyll	1/29/2008	
		dissolved oxygen	5/30/2007	
		pH	1/29/2008	

Source: http://cdec.water.ca.gov/; for Station B91400, http://www.water.ca.gov/waterdatalibrary/docs/Hydstra/index.cfm?site=B91400



Map File: fig3201_WQ_Monitoring

Figure 3.2-1

Key Surface Water Quality Monitoring Stations Near Prospect Island

Surface water quality near Prospect Island

Salinity

Salinity is the measure of total dissolved solids (TDS) concentration in water determined by passing a sample through a filter, evaporating the water, and determining the mass of the salts left behind. Because the analytical methods used to measure salinity are time consuming and expensive, direct electrical conductivity (EC) measurements coupled with region-specific relationships between EC and TDS are often used as an analog. For the purposes of this document, correlations of TDS and EC measurements from the Sacramento River Watershed were used for salinity conversions (Systech Water Resources 2011). For reference, fresh water is considered to have a dissolved salt content of less than one part salt per thousand parts water (ppt), while brackish water has from one to 25 ppt dissolved salt content. In comparison, ocean water has a dissolved salt content of approximately 35 ppt.

One measure of saline intrusion from the San Fransisco Bay into the Delta is the “X2 point” —the distance measured in kilometers from the Golden Gate Bridge upstream to where salinity measured one meter off the river bottom is 2 ppt. Over a 40-year period, from 1988 to 2007, the X2 point has averaged 74 kilometers (USBR et al. 2011) (Figure 3.2-2). However, when tides are particularly strong and/or downstream flows particularly weak, the X2 point may extend inland to 98 km, approximately the distance (by water) to Rio Vista on the Sacramento River, just downstream of the Project site.

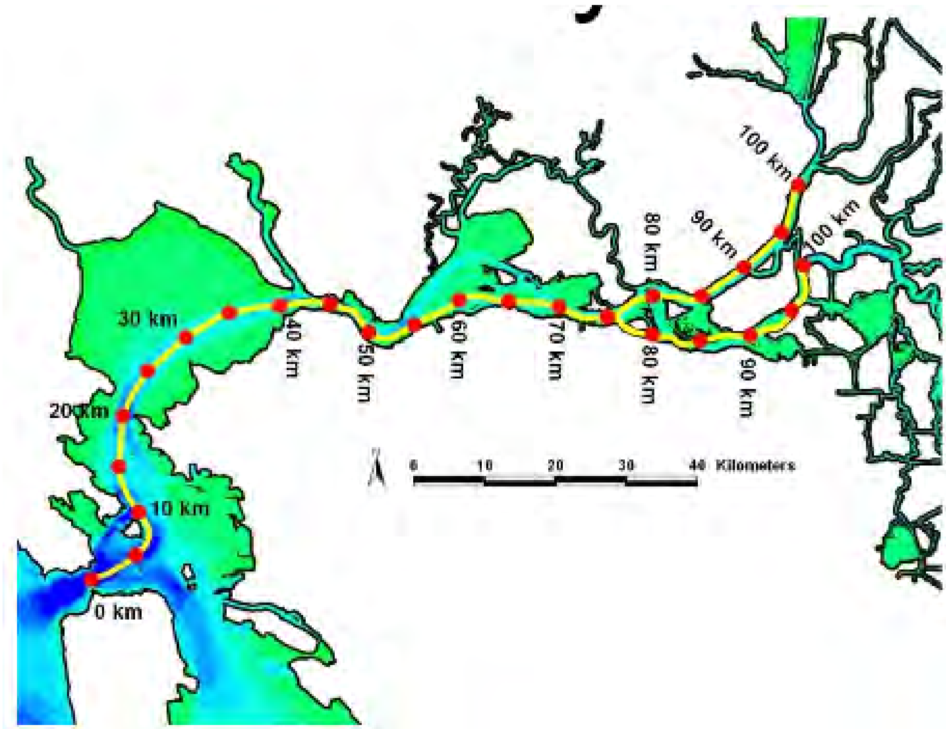


Figure 3.2-2. Distances (in 5-km Increments) from the Golden Gate Bridge (located at 0 km) to Various Points in the Bay-Delta.

In the Proposed Project vicinity, continuous electrical conductivity measurements were analyzed for water year 2012 since it represents the most recent near-normal hydrologic conditions based on classification indices for the Sacramento Valley (http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsihist). Measurements indicate generally low (<1 ppt) average salinity that varies seasonally with hydrologic regime (Table 3.2-2, Section 3.1.1 Hydrology – Setting). Periodic instances of relatively higher electrical conductivity and salinity were observed during the winter and late fall months. As compared to other sites in the vicinity, salinity was generally lower in Miner Slough at the Hwy 84 Bridge (HWB) and higher in the DWSC (DWS) and Liberty Island (LIB).

Table 3.2-2. Monthly Mean Electrical Conductivity and Salinity for Water Year 2012

Month	Year	Conductivity (uS/cm) and Salinity (ppt)									
		HWB		DWS		LIB		RYI		RIV	
		uS/cm	ppt	uS/cm	ppt	uS/cm	ppt	uS/cm	ppt	uS/cm	ppt
Oct	2011	180	0.12	257	0.17	265	0.18	232	0.15	216	0.14
Nov	2011	200	0.13	301	0.20	301	0.20	271	0.18	221	0.15
Dec	2011	156	0.10	304	0.20	294	0.20	259	0.17	173	0.12
Jan	2012	137	0.09	328	0.22	297	0.20	248	0.17	139	0.09
Feb	2012	126	0.08	259	0.17	200	0.13	222	0.15	155	0.10

Month	Year	Conductivity (uS/cm) and Salinity (ppt)									
		HWB		DWS		LIB		RYI		RIV	
		uS/cm	ppt	uS/cm	ppt	uS/cm	ppt	uS/cm	ppt	uS/cm	ppt
Mar	2012	144	0.10	193	0.13	173	0.12	186	0.12	156	0.10
Apr	2012	121	0.08	159	0.11	141	0.09	165	0.11	127	0.08
May	2012	140	0.09	168	0.11	152	0.10	179	0.12	144	0.10
Jun	2012	167	0.11	213	0.14	208	0.14	211	0.14	192	0.13
Jul	2012	119	0.08	187	0.12	168	0.11	174	0.12	133	0.09
Aug	2012	145	0.10	194	0.13	190	0.13	192	0.13	158	0.11
Sep	2012	162	0.11	220	0.15	225	0.15	214	0.14	181	0.12

Source: California Data Exchange Center online database: http://cdec.water.ca.gov/

Water temperature

The range and patterns of water temperature play a vital role in determining physiological processes and behavior of aquatic species. Species-specific water temperature ranges for fish species associated with Prospect Island are discussed in Section 3.2 Water Quality.

Data from the Cache Slough at Ryer Island (RYI) and Miner Slough at Hwy 84 Bridge (HWB) monitoring stations were examined for water year 2012 in order to characterize typical water temperature patterns in Miner Slough adjacent to the Project site (http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsihist). Water temperature was generally lower at the Miner Slough stations (HWB) as compared to the Ryer Island station (RYI) and varied from about 47 to 74 ^{o}F (8 to 23 ^{o}C) (Table 3.2-3). Water temperatures follow a seasonal pattern, tending to be coolest in the late fall and winter and gradually increasing to peak in the summer. As these two monitoring stations, located upstream and downstream of Prospect Island, exhibit similar seasonal temperature patterns, Miner Slough adjacent to Prospect Island is expected to experience them as well (Figure 3.2-1).

Table 3.2-3. Monthly Mean Water Temperature for Water Year 2012

Month	Year	Temperature in ^{o}F (^{o}C)	
		HWB	RYI
Oct	2011	62 (17)	63 (17)
Nov	2011	54 (12)	56 (13)
Dec	2011	48 (9)	47 (8)
Jan	2012	48 (9)	49 (9)
Feb	2012	52 (11)	54 (12)
Mar	2012	53 (12)	59 (15)
Apr	2012	59 (15)	64 (18)

Month	Year	Temperature in °F (°C)	
		HWB	RYI
May	2012	66 (19)	68 (20)
Jun	2012	70 (21)	72 (22)
Jul	2012	70 (21)	74 (23)
Aug	2012	70 (21)	73 (23)
Sep	2012	68 (20)	72 (22)

Dissolved oxygen

Dissolved oxygen is an important environmental water quality parameter routinely monitored for the protection of aquatic organisms, including fish and benthic macro-invertebrates. The closest dissolved oxygen monitoring station to the Project site is located at the Sacramento River Highway-12 Bridge in Rio Vista (RVB). For water year 2012, dissolved oxygen ranged from 6.9 mg/L to 10.9 mg/L, with an overall mean of 9 mg/L. Seasonally, dissolved oxygen concentrations were generally higher (> 9 mg/L) with increased solubility due to lower water temperatures during late fall and winter, and correspondingly lower (< 8 mg/L) due to higher water temperatures during the summer (Figure 3.2-3).

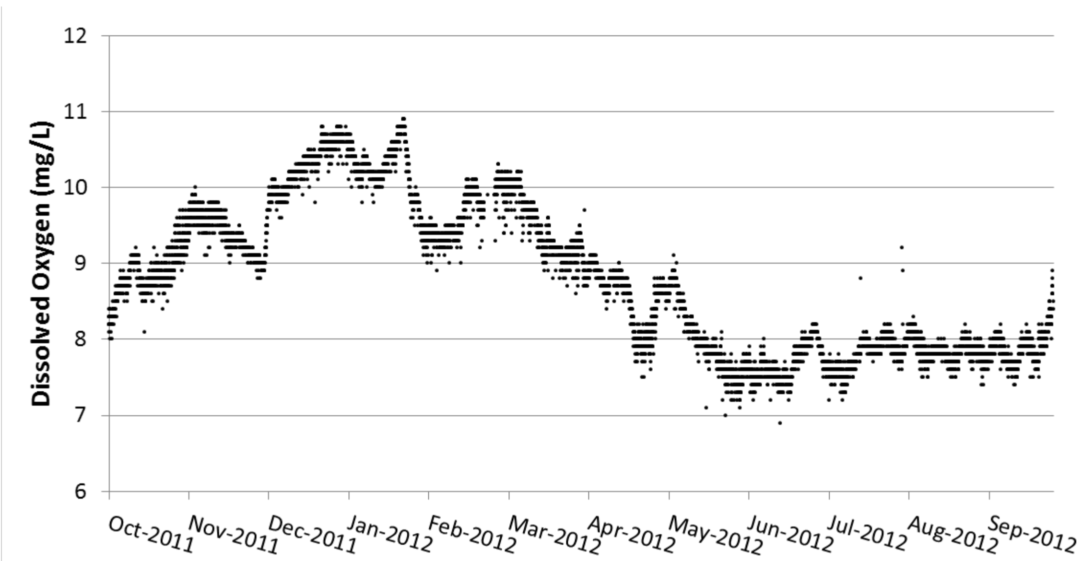


Figure 3.2-3. Hourly Dissolved Oxygen (mg/L) Measured at the Sacramento River at the Highway-12 Bridge in Rio Vista (RVB) Monitoring Station in Water Year 2012 (Below Normal Water Year Type[2])

[2] Sacramento Valley Water Year Hydrologic Classification (http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsihist)

Turbidity

Water in the natural environment commonly carries with it some measurable load of suspended particles of varying sizes. This material may be composed of inorganic and organic materials, originating from sediment erosion and resuspension, algae, and other microscopic organisms. Turbidity is the relative measurement of water clarity in standard Nephelometric Turbidity Units (NTU). Water quality standards for turbidity are generally intended to minimize the amount of turbidity for protection of beneficial uses (Table 3.2-7).

Turbidity measurements have been collected on a continuous basis at several locations and for extensive periods in the Proposed Project vicinity (Table 3.2-1). These data in addition to observations of local suspended sediment flux indicate seasonal and storm event variation. In general, high concentrations of suspended sediments have been observed in Miner Slough during the first significant surface flush of the rainy season and when Sacramento River flow exceeds 560 m^3s^{-1} (20,000 cfs) (Morgan-King and Schoellhamer 2013). Turbidity measurements collected both upstream (HWB) and downstream (RYI) of the Project site show generally low turbidity throughout the late fall and winter with periods of elevated turbidity readings in the spring and summer (Figure 3.2-4, Figure 3.2-5). Comparatively, turbidity in Miner Slough at Hwy 84 Bridge (HWB) is lower than that of Cache Slough at Ryer Island (RYI), except during storm events.

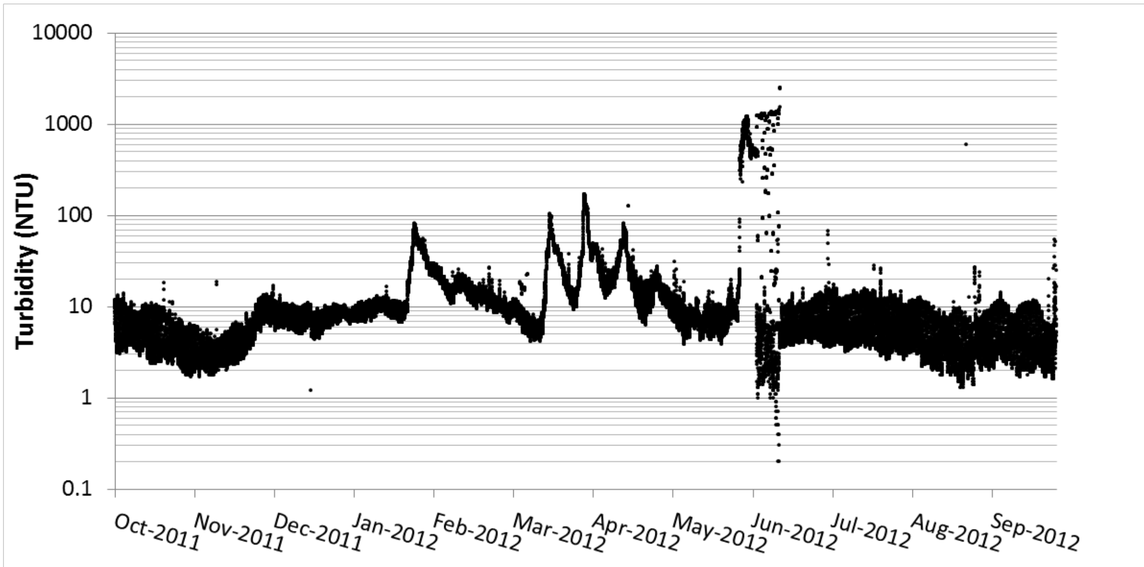


Figure 3.2-4. Turbidity Measured in Miner Slough at Hwy 84 Bridge (HWB) during Water Year 2012 (Below Normal Water Year Type[3])

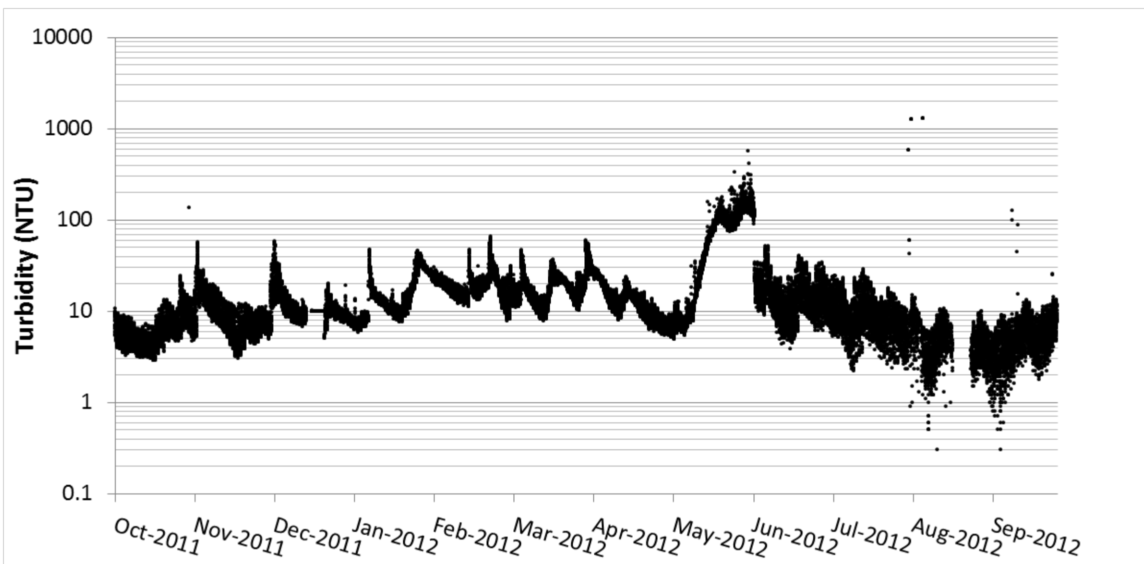


Figure 3.2-5. Turbidity Measured in Cache Slough at Ryer Island (RYI) during Water Year 2012 (Below Normal Water Year Type[3])

Methylmercury

Methylmercury (chemical formula: $[CH_3Hg]^+$) is the organic form of mercury most commonly found in the environment. Original sources of inorganic mercury to the Central Valley are upstream tributaries where historical mining of mercury in the Coast Ranges and gold in the Sierra Nevada and Klamath-Trinity Mountains

[3] Sacramento Valley Water Year Hydrologic Classification (http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsihist)

caused contamination of water and sediment on a regional scale (Alpers et al. 2008). Methylation of inorganic mercury occurs in the aquatic environment under low oxygen conditions by naturally occurring sulfur- and iron-reducing bacteria (Gilmour et al. 1992, Benoit et al. 2003, Kerin et al. 2006). This process allows organic mercury (methylmercury) to enter the food web where it can be toxic at elevated concentrations. Since methylmercury tissue concentrations tend to biomagnify within the food web, higher-trophic level species (e.g., fish, birds, mammals) can have mercury levels several orders of magnitude greater than those at lower trophic levels (e.g., algae, zooplankton, small invertebrates). Furthermore, since methylmercury can be retained in tissue (rather than being readily excreted or broken down), higher trophic level species may experience toxic tissue concentrations even when ambient water concentrations are hundreds of times lower and at otherwise non-toxic concentrations (Weiner et al. 2003). Developing fetuses, young humans and piscivorous wildlife are primarily at risk, from consumption of mercury-contaminated fish (Fitzgerald et al. 1998).

Elevated fish tissue mercury levels have been found throughout the Delta (Melwani et al. 2007). Under the Fish Mercury Project and Surface Water Ambient Monitoring Program (SWAMP), fish tissue samples collected from 18 locations in the vicinity of Prospect Island are shown Table 3.2-4. The majority of fish sampled from 1998 to 2007 exhibited methylmercury tissue concentrations higher than applicable water quality objectives of 0.03 mg/kg wet weight (fish less than 50 mm in length), 0.08 mg/kg wet weight (trophic level 3 [TL3] fish), and 0.24 mg/kg wet weight (trophic level 4 [TL4] fish) (Table 3.2-4).

Table 3.2-4. Exceedance Frequency of Basin Plan Methylmercury Objectives, per Trophic Level, for Fish Sampled in the Vicinity of Prospect Island

Sample Location Name	Sample Date	Small Fish[1] (<50 mm)	Trophic Level 3 Fish[1,2] (secondary consumers)	Trophic Level 4 Fish[1, 2] (primary consumers)
Bypass Slough	Jan. 1999	9 out of 9	6 out of 11	N/A
Cache Slough	Jan. 1998	7 out of 8	0 out of 9	N/A
Cache Slough (lower)	Jan. 1999	1 out of 1	0 out of 1	N/A
Cache Slough near Ryer Island Ferry	Jan. 2000	N/A	1 out of 1	0 out of 1
Liberty Island	Jan. 1998	11 out of 12	1 out of 21	20 out of 30
Lindsey Slough	Jan. 1999	8 out of 11	4 out of 14	0 out of 2
Little Hastings Tract	Jan. 1999	3 out of 4	0 out of 3	N/A
Little Holland Tract (north)	Jan. 1999	48 out of 49	0 out of 4	0 out of 1
Little Holland Tract (south)	Jan. 2000	N/A	2 out of 2	15 out of 15
Miner Slough	Jan. 1999	1 out of 1	N/A	N/A

Sample Location Name	Sample Date	Small Fish[1] (<50 mm)	Trophic Level 3 Fish[1,2] (secondary consumers)	Trophic Level 4 Fish[1, 2] (primary consumers)
Old Prospect Slough	Jan. 1998	41 out of 45	3 out of 12	N/A
Prospect Island	Jan. 1999	7 out of 8	1 out of 11	0 out of 10
Prospect Slough (mid-Prospect)	Aug. 2005	N/A	38 out of 39	40 out of 72
Sacramento River at Cache Slough	Nov. 2006	N/A	N/A	7 out 12
Sacramento River at Rio Vista	Aug. 2005	N/A	51 out of 56	39 out of 59
Sacramento Deep Water Ship Channel	Jan. 1999	2 out of 2	0 out of 1	N/A
Sacramento River/Rio Vista	Jan. 1999	1 out of 1	1 out of 4	1 out of 1
Upper Cache Slough (McAvoy Fish Derby)	Feb. 2007	N/A	1 out of 1	N/A
	Totals:	139 out of 151	109 out of 190	122 out of 203

Source: California Environmental Data Exchange Network online database: http://www.ceden.us/AdvancedQueryTool

1 Exceedances (based on wet-weight concentrations) are 0.03 mg/kg for small fish (<50 mm), 0.08 mg/kg for TL 3 fish, and 0.24 mg/kg for TL 4 fish

2 TL 3 fish generally consume zooplankton whereas TL 4 fish often prey on smaller fish

Surface water quality in Prospect Island

The Project site is currently flooded on both the north and south properties. The north property experiences roughly 0.05 ft of daily tidal exchange immediately next to a small culvert when the flap gate is open (Section 3.1.1 Hydrology – Setting). Though no measurements have been made, field observations suggest that the south property experiences a limited tidal exchange with Miner Slough through a porous breach repair of the south levee.

Since January 2011, daily water temperatures have been measured at the Prospect Island Tide Station (B91400 PI-1) located at the pump house on the southeast corner of the north property (Figure 3.2-1). Daily water temperatures have ranged from approximately 41°F to 76°F (5 to 24 °C) and monthly water temperatures varied seasonally, with cooler temperatures in the winter and warmer temperatures in the summer (Table 3.2-5). No other recent water quality data are available from the Project site.

As part of the Prospect Island Ecosystem Restoration Project Initial Study (USACE and DWR 2001), water quality data was collected on the north property from May through November 1997 and June through September 1998 (Table 3.2-5). During this period, electrical conductivity ranged from 113 uS/cm to 235 uS/cm (0.10 to 0.20 ppt salinity). Dissolved oxygen concentrations ranged from 6.3 mg/L to 11.8 mg/L, well above the 5 mg/L Basin Plan minimum for supporting warm freshwater habitat beneficial uses. Turbidity ranged from 12 NTU to 144

NTU, which is typical for a Delta location undergoing varying seasonal weather and flow conditions, including storm and flood events.

Table 3.2-5. Mean Monthly *In Situ* Water Quality Parameters for the Project Site during 1997-1998 and 2011-2014

Month	Water Temperature in °F (°C) 2011–2013[b]	Electrical Conductivity (uS/cm) 1997–1998[a]	Dissolved Oxygen (mg/L) 1997–1998[a]	Turbidity (NTU) 1997–1998[a]
Jan	46 (8)	-	-	-
Feb	50 (10)	-	-	-
Mar	53 (12)	-	-	-
Apr	59 (15)	-	-	-
May	64 (18)	201.4	7.6	67.0
Jun	66 (19)	144.2	8.7	68.4
Jul	67 (19)	146.5	7.9	71.0
Aug	68 (20)	164.5	7.7	68.1
Sep	66 (19)	193.6	8.3	81.1
Oct	62 (17)	171.2	9.0	40.0
Nov	54 (12)	183.1	10.2	30.0
Dec	47 (8)	-	-	-
Overall Minimum:	41 (5)	112.9	6.3	12.0
Overall Mean:	59 (15)	174.3	8.1	61.4
Overall Maximum:	77 (25)	235.0	11.8	144.0
Overall Sample Size:	Continuous	88	88	62

a Continuous (15-minute intervals) *in situ* measurements.
b Individual measurements taken from each of eight sites over one or two days in a given month (1997–1998), such that reported monthly mean values represent n=16 for May, August, and September and n=8 for all other months (adapted from Table 5, USACE and DWR [2001]).

Groundwater

Groundwater quality information for Prospect Island is limited to electrical conductivity measurements collected in 2012 from the periphery of the north property as part of the Prospect Island Site Characterization and Groundwater Monitoring program (Figure 3.1-10). Conductivity results, converted to approximate total dissolved solids (TDS) concentrations indicate an average concentration of 0.46 ppt TDS (Table 3.2-6).

Table 3.2-6. Well Depths and Estimates of Total Dissolved Solids at the Project Site

		Well Categorization[1]			All
		Shallow (23-48 ft)	Intermediate (49-74 ft)	Deep (75-100 ft)	
Sample Size (n)		9	7	4	20
Estimated TDS (ppt)	Minimum	0.14	0.11	0.10	0.10
	Average	0.75	0.16	0.31	0.46
	Maximum	2.18	0.23	0.62	2.18

Source: C. Bonds (DWR) (pers. comm., 2014)
1 Well depths are relative to ground surface

Legal and regulatory setting

The primary laws governing water quality in California are the federal Clean Water Act (Title 33, United States Code Section 1251 et seq.) and the state Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.). States, tribes, and jurisdictional territories are granted regional authorities and responsibilities for water quality control by the federal law. Within California, the Porter-Cologne Act established the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs) as the lead water quality agencies for implementation of those federal water quality programs allocated to the States, and for State water quality control programs and processes.

Water quality control consists primarily of identifying and protecting water quality standards through various planning, regulatory (permitting), and implementation/enforcement programs. This section outlines pertinent aspects of federal, state, and local laws, regulations, and policies that pertain to water quality in the vicinity of Prospect Island.

Federal laws

Unless otherwise noted, the Proposed Project would comply with the following federal laws.

Clean Water Act

The federal CWA is intended to help safeguard the quality of the Nation's waterbodies from point and nonpoint source pollution. Under this law the USEPA has primary administrative and scientific authority, while the USACE implements an important CWA permit program (see reference to CWA Section 404, below). The CWA contains several sections directly or indirectly applicable to surface water quality control at Prospect Island, which are detailed below.

Section 303 (USC Section1313)

CWA Section 303(d) and accompanying federal agency (USEPA) regulations require states, tribes, and territories to biennially list their jurisdictional waterbodies that fail to satisfy minimum water quality standards due to one or more pollutants. These governments must then develop Total Maximum Daily Loads (TMDLs) for those pollutant-waterbody combinations. TMDLs are estimated maximum daily loadings of a particular pollutant that a waterbody can theoretically withstand while still meeting pertinent water quality standards. Inclusion on the “303(d) list” means that water quality permits and certifications issued for projects in the subject area should be appropriately stringent to ensure no additional significant release of problem pollutants.

Section 401 (USC Section1341)

CWA Section 401 establishes the Water Quality Certification program. It requires that applicants for federal licenses or permits also seek certification from the Regional Water Quality Control Board that their proposed projects would not violate federal and state water quality standards. Dredging project applicants are required to test sediments to be dredged for possible toxic contaminants and for general sediment characterization before applying for water quality certification and permits. In general agencies are concerned with the potential discharge of toxic contaminants (in sediments) and the discharge of otherwise “clean” sediments themselves (e.g., resulting in increased turbidity). As an applicant for a Section 404 permit, the Lead Agency for the Proposed Project would seek water quality certification from the CVRWQCB.

Section 402 (USC Section1342)

CWA Section 402 is primarily concerned with the National Pollutant Discharge Elimination System (NPDES) permit program. For many years the most well-known water quality regulatory tool, it is intended to regulate the discharge of pollution from “point sources”—defined in the CWA as “discernable, confined and discrete” (USC Section1362(14)) conveyances (e.g., pipes, tunnels, ditches, vessels, and such). As in other regulatory programs, permits may be *individual* (project-specific) or *general* (issued for a broader category of activities or for a specific geographic region). A specialized portion of the NPDES program focuses on regulating stormwater discharges from municipal, industrial, and construction sites.

The Proposed Project should not require an individual NPDES permit. However, excavation or other construction-related activities must comply with general

NPDES construction stormwater permit requirements, intended to prevent or limit stormwater runoff, including sediment discharge, from construction areas into waters of the State.

Section 404 (USC Section1344)

CWA Section 404 establishes a permit program to control the discharge of dredged or fill materials to waters of the United States. The Proposed Project involves excavation and dredging activities that require a Section 404 permit from USACE. As noted above, the need to acquire a Section 404 permit normally triggers a requirement to seek Section 401 water quality certification.

Rivers and Harbors Act Section 10 (33 USC Section403)

The federal Rivers and Harbors Act (RHA) allows the USACE to control, improve, and regulate constructed structures that might impede navigation along the Nation's waterways for the benefit of commerce, recreation, and public safety. Authorization from the USACE is required for construction in, dredging from, or deposition of material (see CWA Section 404, above) into waters of the United States. The specific activity of dredging from a navigable waterway is what may trigger the need for a Section 10 permit, which, if required, is issued by USACE in conjunction with, or in addition to, a Section 404 permit (see above). Upon application for 404 or RHA permits, the USACE initiates consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to help ensure minimal impacts to sensitive species, including migratory fish.

Safe Drinking Water Act

The federal Safe Drinking Water Act establishes drinking water standards in order to safeguard public health. Delta water downstream of Prospect Island is taken in by various municipalities for treatment for drinking water. Therefore, any pollutants discharged from the Prospect Island area may potentially impact downstream drinking water quality.

State laws and regulations

The Porter-Cologne Water Quality Control Act of 1969, promulgated within California Water Code, authorizes the State water quality agencies to implement pertinent federal CWA programs (see Division 7 California Water Code Section 13160). In addition, Porter-Cologne also establishes separate, autonomous State water quality planning, permit, and enforcement programs that may affect the Proposed Project. Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

Sacramento and San Joaquin River Basin Water Quality Control Plan (Basin Plan) (CWC Section13240)

Water quality control plans are developed by the California water quality agencies (SWRCB and RWQCBs) to outline steps to help ensure that State waters would be suitable and safe for use. These plans may be statewide, regional, or waterbody-specific in scope, and they may address all or any number of pollutants. The primary water quality control plan covering the Prospect Island vicinity is the Sacramento and San Joaquin River Basin Plan (Basin Plan). As outlined in the Basin Plan, water quality control consists primarily of protecting and maintaining water quality standards. Standards consist of (a) designated beneficial uses of water, (b) water quality objectives, and (c) the State's anti-degradation policy. In addition to identification and establishment of water quality standards, the Basin Plan outlines implementation, regulatory (permit), and enforcement programs.

Designated beneficial uses of water

Beneficial uses of water in the vicinity of Prospect Island are designated by the Central Valley Regional Water Quality Control Board (CVRWQCB 2011) (Table 3.2-7).

Table 3.2-7. Beneficial Uses of Water

Human Activity-related	Natural Habitat-related
SURFACE WATER	
• Municipal And Domestic Supply (**MUN**) • Agricultural Supply (**AGR**) • Industrial Process Supply (**PROC**) • Industrial Service Supply (**IND**) • Water Contact Recreation (**REC1**) • Noncontact Water Recreation (**REC2**) • Commercial And Sport Fishing (**COMM**) • Navigation (**NAV**)	• Warm Freshwater Habitat (**WARM**) • Fish Migration (**MIGR**) • Fish Spawning (**SPWN**) • Wildlife Habitat (**WILD**)
GROUNDWATER	
• Municipal And Domestic Supply (**MUN**) • Agricultural Supply (**AGR**) • Industrial Process Supply (**PROC**) • Industrial Service Supply (**IND**)	(not applicable)

Source: CVRWQCB 2011

Water quality objectives

Water quality objectives have been established by the CVRWQCB to protect the designated beneficial uses listed in Table 3.2-8. These protective limits are achieved primarily through the combined, collective issuance of individual water quality permits (and certifications) for significant human-caused sources of pollution. Permits may contain specific numeric limits (i.e., effluent limitations) on pollutant quantities to be discharged or regulate other (e.g., construction) activities in order to help ensure that, collectively and with the benefit of dilution, water quality objectives would be achieved. Table 3.2-8 lists applicable narrative and numeric surface water and groundwater quality objectives for waterbodies in the vicinity of Prospect Island.

Table 3.2-8. Water Quality Objectives Applicable to Waterbodies at or Near the Project site

Pollutant	Narrative Objective	Numeric Objective	
SURFACE WATER			
Bacteria	-	**Water Contact Recreation MCLs**	
		Fecal Coliform	< 200/100 mL (geometric mean of at least five samples, 30-day period)
			< 10% of the total number of samples taken shall exceed 400/100 mL
Biostimulatory Substances	Water shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses.	–	
Chemical Constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.	**Constituent**	**MCL (mg/L dissolved)**
		Arsenic	0.01
		Barium	0.1
		Copper	0.01
		Cyanide	0.01
		Iron	0.3
		Manganese	0.05
		Silver	0.01
		Zinc	0.1
Color	Water shall be free of discoloration that causes nuisance or adversely affects beneficial uses.	–	
Dissolved Oxygen	–	A lower limit of 5.0 mg/L	

<table>
<tr><th>Pollutant</th><th>Narrative Objective</th><th colspan="2">Numeric Objective</th></tr>
<tr><td>Floating Material</td><td>Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.</td><td colspan="2">–</td></tr>
<tr><td rowspan="4">Methylmercury</td><td rowspan="4">–</td><td>Fish Size/Trophic Level[1]</td><td>MeHg Objective (mg/kg wet-weight)</td></tr>
<tr><td>any fish <50 mm in length</td><td>0.03</td></tr>
<tr><td>Trophic Level (TL) 3</td><td>0.08</td></tr>
<tr><td>Trophic Level (TL) 4</td><td>0.24</td></tr>
<tr><td>Oil and Grease</td><td>Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.</td><td colspan="2">–</td></tr>
<tr><td>pH</td><td>–</td><td colspan="2">The pH shall not be depressed below 6.5 nor raised above 8.5.</td></tr>
<tr><td rowspan="7">Pesticides</td><td rowspan="7">No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.
Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses.
Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.
Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies</td><td colspan="2">Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the MCLs set forth in California Code of Regulations (CCR), Title 22, Division 4, Chapter 15</td></tr>
<tr><td>Pesticide</td><td>MCL</td></tr>
<tr><td rowspan="2">Chlorpyrifos</td><td>0.025 ug/L ; 1-hour average (acute)</td></tr>
<tr><td>0.015 ug/L ; 4-day average (chronic)</td></tr>
<tr><td rowspan="2">Diazinon</td><td>0.16 ug/L ; 1-hour average (acute)</td></tr>
<tr><td>0.10 ug/L ; 4-day average (chronic)</td></tr>
<tr><td>Thiobencarb</td><td>1.0 ug/L for municipal and domestic supply</td></tr>
<tr><td>Radioactivity</td><td>Radionuclides shall not be present in concentrations that are harmful to human, plant, animal or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.</td><td colspan="2">At a minimum, waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the MCLs specified in CCR Title 22</td></tr>
</table>

Pollutant	Narrative Objective	Numeric Objective	
		Beneficial Use	**Criteria**
Salinity	–	Agricultural supply (AGR)	Vary by water year type[2] and D-1641 compliance location (SWRCB 2000)
		Fish (WARM, COLD, MIGR, SPWN) and Wildlife (WILD) habitat	
		Municipal (MUN) and Industrial (IND) supply	250 mg/L maximum mean daily chloride concentration
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.	–	
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.	–	
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.	–	
Taste and Odors	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.	–	
Temperature	The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.	A maximum increase of no more than 5°F.	
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances.	–	

Pollutant	Narrative Objective	Numeric Objective	
Turbidity	For Delta waters, the general objectives for turbidity apply and except for periods of storm runoff, the turbidity shall not exceed 150 NTUs. Exceptions would be considered when a dredging operation can cause an increase in turbidity (allowable zone of dilution may apply).	**Existing Turbidity (NTU) Range**	**Maximum Allowed Increase**
		< 1	Total shall not exceed 2 NTU
		1 to 5	1 NTU
		5 to 50	20%
		50 to 100	10 NTU
		> 100	10%
GROUNDWATER			
Bacteria	–	In ground waters used for domestic or municipal supply (MUN) the most probable number of coliform organisms over any seven-day period shall be less than 2.2 per 100 ml.	
Chemical Constituents	Ground waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.	Where designated for domestic or municipal supply (MUN) must not exceed pertinent MCLs defined in CCR Title 22	
Radioactivity	–	Where designated for domestic or municipal supply (MUN) must not exceed pertinent MCLs	
Tastes and Odors	Ground waters shall not contain taste- or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses.	–	
Toxicity	Ground waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial use(s).	–	

Source: CVRWQCB 2011

1 Trophic Level 3 fish generally consume zooplankton whereas Trophic Level 4 fish often prey on smaller fish.

2 Sacramento Valley Water Year Hydrologic Classification (http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsihist)

Drinking water objectives

The Sacramento-San Joaquin Delta is recognized as a source of drinking water for approximately 60 percent of California's population. SWRCB Resolution Number 88-63 states that (with certain exceptions) "all surface and ground waters of the state are to be protected as existing or potential sources of municipal and domestic supply" (Page IV-9.00, CVRWQCB 2011). The exceptions include waters with existing high TDS concentrations greater than 3,000 mg/L, low sustainable yield, or contamination that cannot be reasonably treated. CVRWQCB Resolution R5-2013-0098, adopted in 2013, adds drinking water policy for Delta surface waters (including at Prospect Island) into the Basin

Plan. The Policy focuses on salinity, excess nutrients, organic carbon, and pathogens (especially *Cryptosporidium* and *Giardia*) as drinking water constituents of particular concern. This Policy is awaiting, but expected to receive, final State and federal authorization.

Taken together, these policies mean that the quality of water in Miner Slough and nearby waterbodies must satisfy drinking water standards. Additionally, the Barker Slough Pumping Plant, located approximately eight miles due west of Prospect Island, is a current drinking water intake for the SWP's NBA (Figure 3.1-3). The NBA supplies water to Napa, Vallejo, and Benicia.

The Basin Plan incorporates State Water Resources Control Board (SWRCB) Division of Drinking Water numeric drinking water standards—maximum contaminant levels (MCLs)—which apply to source (ambient) waters as well as treated water systems (Table 3.2-9). Primary MCLs protect environmental health, while secondary MCLs address the aesthetics of drinking water, such as odor, color, and taste.

Table 3.2-9. Selected SWRCB- Division of Drinking Water Maximum Contaminant Levels (MCLs) for Drinking Water

Contaminant	MCLs
PRIMARY MCLs - mg/L	
Inorganic Chemicals	
Arsenic	0.01
Cadmium	0.005
Hex. Chromium	0.01
Copper	1.3
Lead	0.015
Inorganic Mercury	0.002
Nickel	0.1
Selenium	0.05
Organic Chemicals	
Benzene	0.001
PCBs	0.0005
Toluene	0.15
SECONDARY MCLs	
Color (color units)	15
Foaming Agents	0.5
Odor (odor units)	3
Turbidity (NTU)	5

Contaminant		MCLs
TDS (mg/L)	Recommended	500
	Upper	1,000
	Short Term	1,500
Specific Conductance (uS/cm)	Recommended	900
	Upper	1,600
	Short Term	2,200

Source:
http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.shtml
All metals expressed as total concentrations

In addition to the inorganic and organic contaminants and physical characteristics covered by primary and secondary MCLs, high levels of dissolved organic carbon (DOC) can lead to the formation of disinfection byproducts during potable water treatment. These include trihalomethanes, haloacetic acids, and other carcinogenic compounds formed during chlorine or ozone disinfection. The USEPA has established an MCL of 80 ppb for trihalomethanes in drinking water (USBR and DWR 2005). Potential sources of DOC to the Delta include storm water runoff, wastewater discharges, agriculture and animal husbandry, as well as any dead organic (plant) material entering a waterbody and the erosion or discharge of soils containing large concentrations of organic materials (Chapter 2 of DWR 2013b).

Antidegradation policy

Federal (CWA-based) regulations require the states to develop an antidegradation policy (40 CFR Section131.12). Such policy is intended to maintain already existing high-quality water conditions, and to prevent purposeful degradation of otherwise high water quality to allowable minimum standards. Per those federal requirements, the State of California antidegradation policy (CVRWQCB 2011; Page IV-8.00) is intended to maintain already existing high water quality conditions. The policy states that the water quality of waterbodies with above-average existing conditions should not be diminished even if resulting quality would still satisfy minimum standards.

303(d) list of water quality-limited segments

Northern Delta surface waterbodies, including the channels around Prospect Island (e.g., Miner Slough, the DWSC), are currently listed as impaired in multiple pollutant categories (Table 3.2-10).

Table 3.2-10. Pollutants Included on the 2008-2010 CWA Section 303(d) List of Water Quality Limited Segments for the North Delta

Pollutant	Pollutant Category
Chlordane	Pesticide
Chlorpyrifos	Pesticide
DDT	Pesticide
Diazinon	Pesticide
Dieldrin	Pesticide
Group A pesticides	Pesticide
Invasive Species	Miscellaneous
Mercury	Metals
PCBs	Other organic compounds
Unknown Toxicity	Toxicity

Total maximum daily loads

A particular TMDL usually targets a specific pollutant or suite of similar, related (physical, chemical, or biological) pollutants affecting a single waterbody or waterbody segment. TMDLs take into account existing total pollutant loads from human and natural causes; point source and nonpoint source pollutant discharges; and a margin-of-error safety factor value. Existing TMDLs that apply to Prospect Island area waterbodies include diazinon and chlorpyrifos and mercury, which are described briefly below.

Diazinon and chlorpyrifos

The Sacramento San Joaquin Delta Diazinon and Chlorpyrifos TMDL is approved and effective as of October 10, 2007. Diazinon is a fat-soluble, non-systemic organophosphate insecticide. Though banned for residential use in 2004, it may still be used by agriculture. Chlorpyrifos is also an organophosphate insecticide, used commonly on crops such as cotton, corn, almonds, and other fruit trees. Both compounds have the potential to cause acute toxicity in invertebrates and vertebrate organisms (especially fish and amphibians), including humans (in large enough doses).

The TMDL for these two pesticides applies specifically to Miner Slough, the DWSC, Prospect Slough, and Cache Slough (Appendix 42 in CVRWQCB 2011).

Diazinon water quality objectives, not to be exceeded more than once in a 3-year period, are the following:

- 0.16 micro-grams per liter (ug/L) (1-hour average) (acute)
- 0.10 ug/L (4-day average) (chronic)

Chlorpyrifos objectives, not to be exceeded more than once in a 3-year period, are the following:

- 0.025 ug/L (1-hour average) (acute)
- 0.015 ug/L (4-day average) (chronic)

The Proposed Project does not involve the use, application, or discharge of these chemicals. Therefore, this TMDL is not applicable to the Proposed Project and is not discussed further.

Methylmercury

A Sacramento-San Joaquin Delta methylmercury TMDL was approved and effective as of October 20, 2011. This TMDL applies specifically to Miner Slough, the DWSC, Prospect Slough, and Cache Slough (Appendix 43 in CVRWQCB 2011). The current TMDL target is in the form of maximum average fish tissue concentration levels for animals in various trophic levels and at different sizes (Table 3.2-8). Multiple environmental factors affect mercury bioaccumulation and trophic transfer through the Delta food web, including physical-chemical properties of the habitat that affect the formation and degradation (e.g., photodemethylation) of methylmercury, exposure time to methylmercury (via diet for higher trophic levels), and the mobility, longevity, and growth rate of organisms ingesting it. Factors controlling methylmercury production and export from restored Delta freshwater tidal wetlands have yet to be fully investigated. Import and export loads of methylmercury have never been quantified in freshwater tidal wetlands, and only one study has been done of methylmercury loads in a saltwater tidal marsh (Mitchell et al. 2012).

Because the cycle of methylmercury formation, transport, transformation, and fate within the Delta is not fully understood, the Basin Plan requires that regulated dischargers to Delta waters participate in control studies intended to investigate (a) the production of methylmercury in, and downstream transport from, key habitats and (b) practical management practices that may reduce production and export of this compound. Currently, DWR and CDFW are developing ambitious methylmercury control studies, as approved by the Central Valley Water Board, to assist in determining freshwater tidal wetland imports and exports of methylmercury. These studies would help DWR and CDFW determine whether tidal wetlands are a significant source or sink (or both) of methylmercury and total mercury, and may help inform restoration plan designs and management practices that could be used to lessen any impacts of methylmercury production in freshwater tidal wetlands.

Waste discharge requirements (WDRs)

As established by the Porter-Cologne Act, WDRs are water quality permits issued by the California Water Boards to dischargers of pollution into State waters (California Water Code Section 13260). The Water Boards maintain the authority to issue WDRs to any suspected discharger. However, if Water Quality Certification is issued to an applicant seeking a federal license/permit, WDRs are not normally issued separately. WDRs may be required for some aspects of dredging. See discussion, below, on possible federal and State dredging requirements.

California Toxics Rule

California adopted the California Toxics Rule in 2000, based on the USEPA's prior issuance of the National Toxics Rule in 1982. As the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (amended in 2005), the rule adopts and implements priority pollutant criteria; establishes standardized approach for permitting discharges of toxic pollutants to California's non-ocean waters; and generally updates, refines, and standardizes a pattern for water quality control that would be absorbed into the regional basin planning and water quality control efforts. This policy influences regulatory programs, such as water quality certification, that may be applied to the Proposed Project by the RWQCB.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Solano County General Plan ordinances and policies

Prospect Island is located in Solano County; and is upstream of Contra Costa and San Joaquin County waterbodies. Chapter 4 of the Solano County General Plan (Solano County Board of Supervisors 2008) includes the following water quality related goal and associated policies:

Goal:

RS.G-10: Foster sound management of the land and water resources in Solano County's watersheds to minimize erosion and protect water quality using best management practices and protect downstream waterways and wetlands. (Page RS-6)

Associated Policies:

RS.P-28: Protect long-term water quality in the Delta in coordination with water agencies at local, state, and federal levels for designated beneficial uses, including agriculture, municipal, water-dependent industrial, water-contact recreation, boating and fish and wildlife habitat. (Delta policies; Page RS-29)

RS.P-73: Use watershed planning approaches to resolve water quality problems. Use a comprehensive stormwater management program to limit the quantity and increase the water quality of runoff flowing to the county's streams and rivers. (Page Rs-77)

3.2.2 Significance criteria

Criteria for determining significant impacts on water quality are based upon the *State CEQA Guidelines* (Appendix G) and professional judgment. Effects on water quality are considered significant if the Proposed Project would:

- Result in substantial adverse effects on beneficial uses of water.
- Violate existing water quality standards, waste discharge requirements, or otherwise substantially degrade water quality.
- Result in substantial adverse effects on public health or environmental receptors.
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

3.2.3 Impacts and mitigation

Impact 3.2-1: Short-term construction-related water quality impacts

Dewatering discharges, stormwater run-off and erosion, leaking construction equipment, and accidental spills occurring during site preparation and construction of the Proposed Project could result in short-term discharges of salinity, turbidity, petroleum-based products, and floating materials to receiving waters. These potential short-term discharges could cause exceedances of Basin Plan water quality objectives and impact associated beneficial uses.

Salinity of surface water at Prospect Island was previously shown to be on the order of 0.1–0.2 ppt (Table 3.2-5) with salinity ranges in shallow groundwater wells on the order of 0.1–2.2 ppt (Table 3.2-6). While dewatering activities may potentially result in discharges of waters with elevated salinity in excess of the 0.25 ppt thresholds for municipal (MUN) and industrial (IND) supplies (Table 3.2-8), existing salnity levels on-site are well below the 4–12 ppt toxicity thresholds to support aquatic life (CVRWQCB 2000). Further, because there are no water diversions for MUN and IND water supplies within the vicinity of Propsect Island, it is expected that no measurable increases in salinity or salinity-related impacts to these uses will result from potential discharges of dewatering operations under the Proposed Project.

For dicharges of pollutants listed above other then salinity, implementation of Mitigation Measures 3.2-1.1, 3.2-1.2 and 3.2-1.3 would reduce these potential short-term impacts to less than significant.

Mitigation Measure 3.2-1.1

A site dewatering plan shall be developed by the construction contractor and submitted to DWR for approval prior to commencement of construction activities. The site dewatering plan shall include items such as the following:

- Detailed description of work to be performed to control surface water at the Project site.
- Detailed description of methods, installation and details of the dewatering systems proposed to be used.
- Drawings showing the detailed layout of dewatering systems including pumps, ditches, berms, discharge lines, BMPs, and barriers to shield or divert flow.
- Supporting design information including design calculations prepared by a California Registered Civil Engineer, type of systems, sizes, capacities, proposed number and layout of pumps, depths, filters, other needed equipment, and power supply.
- Information related to backup pumping systems, backup power systems, and warning systems to protect against power failure, system failure, and high groundwater.
- Information related to operation, maintenance, monitoring, removal, decommissioning pumps, and system abandonment procedures.

- Information related to discharge including methods to monitor turbidity and water treatment if necessary.
- Provisions for handling significant rainfall events (greater than 0.5 inches predicted in a 24-hour period as described in the SWPPP). This shall also include procedures to be followed prior to the forecasted significant rain events.
- Provisions for handling emergency situations such as power outages, equipment failures, pumping system shutdowns and the proposed response.
- Information on schedule and sequencing of dewatering activities.
- Information on dewatering operations shall be coordinated with other construction operations including placement of compacted soil, removal and placement of pipe, and other miscellaneous items.

Mitigation Measure 3.2-1.2

Upland areas of the Proposed Project associated with staging activities shall be covered by a Stormwater Pollution Prevention Plan (SWPPP). All contractors working in a capacity that could increase the potential for adverse water quality impacts would receive training regarding the need to minimize impacts. Contractors would also be familiar with general storm water construction-site BMPs for the protection of water quality. The SWPPP may include, but would not be limited to, the following:

1. Use of vegetated buffers, hay wattles or bales, sandbags, silt screens, or other erosion control measures to intercept runoff from construction, excavation, or staging areas to adjacent waterbodies.
2. BMPs for staging of construction supplies and waste management.

Mitigation Measure 3.2-1.3

A Spill Prevention, Control, and Response Plan shall be developed by the construction contractor and submitted to DWR for approval prior to commencement of construction activities. Spill prevention and cleanup kits, equipment, and materials shall always be in close proximity to locations of hazardous materials (e.g., at fueling and staging areas) and conveniently located to allow rapid response. Prior to entering the work site, all field personnel would be informed of the location of the spill prevention and cleanup kits and appropriately trained in spill prevention, hazardous material control, and spill cleanup. The work site would be routinely inspected to verify that the Plan is properly implemented. The Plan would include:

1. A vehicle inspection and fueling plan.

2. BMPs for spill prevention and containment.
3. Locations and uses of spill prevention materials, cleanup kits, and equipment.
4. Qualification and reporting requirements for a federal reportable spill (40 CFR 110) including contact information for the RWQCB and the California Department of Toxic Substances Control (DTSC).

Impact significance
Less than significant with mitigation

Impact 3.2-2: Short-term construction-related increases in turbidity from dredging and excavation of levee breaches

The Proposed Project has potential to increase turbidity and suspended sediment levels within Miner Slough and in downstream waters during mechanical dredging of the spur channel on the south property and excavation of two levee breaches along Miner Slough on both the north and south properties. Short-term increases in turbidity in Miner Slough and downstream waters would potentially occur at levels that could exceed Basin Plan water quality objectives during, and in the immediate days following, these construction activities.

Mechanical dredging of Miner Slough spur channel
Mechanical dredging of the Miner Slough spur channel using a clamshell dredge would remove 47,000 cubic yards of material at a depth of 8–11 ft to allow unimpeded tidal exchange to occur through the southern breach to Miner Slough. Clamshell dredging can re-suspend sediments during bucket lifting and can generate a temporary plume that increases suspended sediment concentrations above background measurements by 150-900 mg/L and turbidity by 5-40 NTU in the general vicinity of the dredge site (Palermo et al. 1990, USACE 1987).

Mechanical dredging would occur during the in-water work window of July 1 through October 31 (Section 2.2.2 Proposed Project Actions – Description of Project components and construction activities), when flows in the Delta are typically lowest, and, when low tide corresponds with work hours,would occur at low tides, when diminished water levels would expose the greatest fraction of material to be excavated above the water line. In addition, because the Miner Slough spur channel is a dead-end channel with limited tidal exchange, suspended sediment generated by the dredging activities would most likely settle within the channel and would not move into Miner Slough, minimizing the potential for violation of turbidity standards or substantial degradation of water quality in the slough.

As part of the Proposed Project and prior to any substantial work, planned locations for soil excavation would be sampled and tested for chemical and geotechnical properties. To determine whether excavated soils are suitable for beneficial reuse in aquatic and upland areas, chemical testing of these soils would include CAM 17 metals, percent solids, TRPH, as well as organochlorine and organophosphate pesticides (Section 2.2.3). If the material does not meet environmental screening criteria, it would not be reused for the Proposed Project. If the dredged materials meet environmental screening criteria, they would be beneficially re-used on site to construct the eastern toe berm, eastern intertidal bench, and interior topographic features, and to fill ditches on the Project site (Section 2.2.3). Because mechanically dredged excavated sediments typically have a solid content comparable to that of *in situ* sediments, it is expected that evaporative drying during handling and after placement would be sufficient for dewatering of Miner Slough dredged sediments, with no decant or drainage water discharge to the exterior waterways surrounding the Project site (Section 2.2.3).

Despite these measures, and given that background turbidity during the in-water work window (July 1 through October 31) is typically low (Section 3.2.1 Water Quality – Setting), the use of turbidity controls (e.g., silt curtains) is included in Mitigation Measure 3.2-2.1 to decrease the potential for short-term increases in suspended sediments or turbidity in Miner Slough that may exceed Basin Plan water quality objectives. Implementation of Mitigation Measure 3.2-2.1 would reduce potential impacts from dredging to less than significant.

Excavation of Miner Slough levee breaches

Excavation of two levee breaches to Miner Slough totaling 1,060 ft in length and 50,800 cubic yards in volume (above and below MHHW) (Table 2.2-3) would occur under the Proposed Project in order to reconnect the Project site to tidal action. Levee breaches would occur at the end of the restoration project from August to mid-November 2018.

The potential for short-term, sediment re-suspension from levee excavation would be minimized by working from the dewatered landward side toward tidal waters in Miner Slough to breach the levee, such that water would slowly equilibrate on both sides of the levee and avoid a surge of turbidity into Miner Slough. For necessary in-water work, excavation of the levee breaches would occur over a maximum period of a few hours to one day at each location and would mostly occur during slack low tide and early flood tide periods. This would allow the greatest fraction of material to be excavated above the water line and also allow suspended sediments to settle within Prospect Island prior to the following ebb tide. Therefore, any increases in turbidity in Miner Slough as a result of levee breach excavation would be temporary and localized.

As part of the Proposed Project and prior to any substantial work, planned locations for soil excavation would be sampled and tested for chemical and geotechnical properties. To determine whether excavated soils are suitable for beneficial reuse in aquatic and upland areas, chemical testing of these soils would include CAM 17 metals, percent solids, TRPH, as well as organochlorine and organophosphate pesticides (Section 2.2.3). If the excavated soils do not meet environmental screening criteria, they would not be reused for the Proposed Project. If the excavated soils do meet environmental screening criteria, they would be beneficially re-used on site as described for the spur channel dredge materials and no decant or drainage water would be discharged to the exterior waterways surrounding the Project site (Section 2.2.3).

DWR is currently working with the CVRWQCB to obtain a Clean Water Act Section 401 Certification for the Proposed Project. The conditions set forth in the certification would be followed to prevent adverse effects to water quality. Water quality monitoring would occur during both dredging and excavation activities to ensure that the Proposed Project is in compliance with 401 Certification conditions. Coordination with the CVRWQCB would establish construction requirements to prevent violation of water quality standards set forth in the Basin Plan and to ensure that water quality is not substantially degraded through Proposed Project activities. These activities, along with implementation of Mitigation Measure 3.2-2.1 would reduce potential impacts from dredging to less than significant.

Mitigation Measure 3.2-2.1

1. Appropriate turbidity control measures (e.g., silt curtains) shall be required during all dredging operations. Selection of appropriate turbidity control measures would consider tidal forces in Miner Slough and would be designed to be robust and effective. Turbidity measures would be in place 1–2 days prior to commencement of dredging operations and would be positioned slightly above the bottom sediments allowing aquatic species to escape entrapment.

2. The cycle time of the ascending loaded dredging bucket shall be limited to a velocity that reduces the potential to wash sediment out of the bucket.
3. The number of bites performed per cycle shall be limited to 1 to reduce sediment re-suspension from opening and closing the dredging bucket.

Impact significance

Less than significant with mitigation

Impact 3.2-3: Short-term construction-related effects from application of aquatic herbicides

The Proposed Project includes application of aquatic herbicides for invasive plant species control to approximately 504 ac of the Project site. The potential effects of herbicides and/or adjuvants in the Proposed Project area on water quality are assessed by considering herbicide type, product, application method, frequency, and amount applied (Table 3.2-11), as well as location of application (i.e., aquatic, riparian, upland), toxicity potential and exposure levels of concern, and consideration of DWR's approach to herbicide transport. As there are no specific water quality standards for aquatic herbicides included in the Basin Plan (Table 3.2-8), a significant water quality impact is defined as one that would result in toxicity to aquatic species and substantially adverse effects on fisheries-related beneficial uses of water.

Application method and frequency

Under the Proposed Project, following dewatering of the site, herbicides approved for aquatic uses would potentially be applied to broad areas within Prospect Island (i.e., up to 411 ac within agricultural ditches and in moderate subtidal (< 0 ft NAVD 88) habitats). Where possible, spot application, allowing the greatest control over and least possible impact from herbicide application, would be used to target particular plants. However, given the large area of potential application, aerial application may be required to most effectively target invasive species at the Project site. To ensure their efficacy, herbicides would be applied to dewatered areas of Prospect Island previously colonized by invasive plant species following initial drawdown during the month of October (Table 2.2-6). As a conservative estimate, the amount to be applied corresponds to the maximum allowable rate per acre for aquatic applications, as published on product labels (Table 3.2-11). Because aquatic herbicide application would occur on dewatered soils, water quality impacts would be limited. However, herbicides have the potential to be transported into surrounding waterways via spills, aerial drift during application, runoff, and via pumped discharge during intermittent site dewatering. Thus, toxicity potential and exposure levels of concern are considered for each of the herbicide types that may be used under the Proposed Project.

Table 3.2-11. Aquatic-approved Herbicides, Application Method, Frequency, and Amount, Which May Be Used for Control of Invasive Emergent Vegetation on Prospect Island

Herbicide Type	Product	Application Method	Application Frequency	Amount to be Applied[1]
Imazapyr	Habitat, Polaris	Spot application (backpack), aerial spray (fixed-wing aircraft or helicopter)	Once following initial dewatering (October)	Approximately 6 pts/ac for up to 411 ac
Glyphosate	Roundup Custom, AquaMaster			Approximately 7.5 pts/ac for up to 411 ac
Aminopyralid	Not specified[2]			

Source: (DWR and CDFW 2014)

1 Maximum allowable rate per acre for aquatic applications as published on the product labels.

2 Awaiting USEPA and California Department of Pesticide Regulation (CDPR) approval for aquatic use prior to Proposed Project implementation.

Toxicity potential

The toxicity potential of herbicides and surfactants is determined using results of USEPA standardized acute and chronic toxicity tests, which are typically performed on broad taxonomic groups of organisms (i.e., birds, mammals, freshwater fish, freshwater invertebrates, estuarine/marine fish, estuarine/marine invertebrates, terrestrial plants, and algae and aquatic plants). Acute and chronic endpoints for the toxicity tests are generally selected based on the most sensitive species tested within the organism group and provide a concentration or dose at which the laboratory test organisms are significantly affected. A common toxicity test metric is the “LC50”, or lethal concentration at which half of the test organisms are killed; LC50 values are reported for a particular exposure time (e.g., 96 hours). Toxicity categories, which are qualitative descriptors of acute toxicity to test organisms, have been adopted by the USEPA for fish and aquatic invertebrates based on Zucker (1985, as cited in USEPA 2002) (Table 3.2-12).

Table 3.2-12. USEPA Aquatic Toxicity Characterizations Based on Results of Acute Aquatic Toxicity Test Results (estimated concentrations that would result in 50% mortality) for Fish, Invertebrate, and Plant (algae) Species

Lethal Concentration (LC50)	Toxicity Characterization
>100	"Practically Non-toxic"
10–100	"Slightly Toxic"
1.0–10	"Moderately Toxic"
0.1–1.0	"Highly Toxic"
<0.1	"Very Highly Toxic"

Source: http://www.epa.gov/espp/litstatus/effects/ne_paraquat.pdf

The following is a brief review of the herbicides and surfactants anticipated for aerial application on Prospect Island for invasive plant species control, along with the associated USEPA toxicity characterization and mobility in the environment.

Imazapyr

Imazapyr, a member of the imidazolinone class of herbicides, is a non-selective, broad-spectrum, systemic herbicide. Imazapyr is relatively mobile in the environment since it is readily transported through soil leaching and surface runoff (USEPA 2007). Primary degradation products of imazapyr are pyridine hydroxy-dicarboxylic acid and pyridine dicarboxylic acid. Habitat and Polaris, the imazapyr-containing products proposed for use on Prospect Island, are both categorized as "practically non-toxic" to fish and invertebrates (BASF Corporation 2014, Nufarm Americas 2012). Algal toxicity has not been tested for these products, however various other imazapyr-containing products are categorized as slightly toxic to algae (SERA 2011b, USEPA 2006). Given its relative mobility in soils and runoff, imazapyr and/or its primary degradation products may be present in runoff and/or pumped discharge from the Project site following its application.

Glyphosate

Glyphosate is a broad-spectrum, systemic herbicide. Glyphosate is immobile in the soil and is rendered inactive over a period of several weeks through microbial degradation (Schuette 1998). Reported soil half-life values range from about 2 to 197 days; in water from about three to 91 days. Its primary degradation product is aminomethylphosphonic acid. There are approximately 50 or more commercial formulations (SERA 2011a), each with potentially differing toxicity. Both glyphosate-containing products, Round-up Custom and Aquamaster, proposed for use on Prospect Island are categorized as "practically non-toxic" to fish and invertebrates and "slightly toxic" to algae (Monsanto 2012). Given the low soil mobility of glyphosate, there is a low likelihood that residue would be present in runoff and/or pumped discharge from the Project site following its application.

Aminopyralid

Aminopyralid is a selective, systemic herbicide (in the pyridine class) intended for use against broadleaf weeds such as thistles and clovers (SERA 2007). Currently four aminopyralid products are registered in California (CDPR 2013). Although a specific aminopyralid-containing product has not been named in the Project Description, this herbicide may be used in place of others mentioned above if approved by USEPA and CDPR. Products that contain aminopyralid are generally categorized as "practically non-toxic" to fish and invertebrates and "slightly to moderately toxic" to algae (SERA 2007). Aminopyralid is mobile in the aqueous phase and is considered non-persistent in soil (EUFootprint 2011, as cited in Newhart 2013).

Surfactants

Herbicides are often mixed with surfactants to ensure greater plant membrane penetration and effectiveness. When added to liquids, surfactants form films consisting of both hydrophilic and hydrophobic molecular layers, which act to lower the surface tension between otherwise incompatible liquids (oil and water, for example) or between a liquid and an otherwise more impermeable solid (e.g., a waxy plant leaf surface). While ecological toxicities for the proposed herbicides are low ("practically non-toxic" to "slightly toxic"), the toxicities of the various surfactant products can range from "practically non-toxic" to "highly toxic" (SERA 2011b). Although herbicide surfactants are generally used at a very low tank mix concentration (0.5%), this may increase toxicity of the final herbicide mixture.

Overall, herbicide type (i.e., aquatic-approved), application method (i.e., to dewatered soils), application frequency (i.e., once immediately following dewatering), amount applied (i.e., according to label specifications), and toxicity potential (i.e., slightly toxic to practically nontoxic), suggest that there is a low likelihood of toxicity- and/or beneficial use-related water quality impacts due to aquatic herbicide application within Prospect Island. This is particularly true for glyphosate, which exhibits low soil mobility and is not likely to be present in runoff and/or pumped discharge following application. Despite this, given the broad-scale application involving aerial spraying and the potential for off-target spray drift and accidental spills, application of aquatic herbicides under the Proposed Project could result in a substantially adverse effect on beneficial uses of water.

Implementation of Mitigation Measures 3.2-3.1 and 3.2-3.2 would reduce these impacts to less than significant.

Mitigation Measure 3.2-3.1

Best Management Practices (BMPs) shall be employed in order to minimize potential impacts to water quality from accidental spills. All contractors working shall receive training regarding the need to minimize impacts. Contractors shall be experienced and compliant in the environmentally-safe application of herbicides. BMPs shall include, but not be limited to, the following:

1. Areas for storage, mixing, and loading of herbicides shall be located where accidental spills to nearby waterbodies cannot occur.
2. Applicators shall be trained in proper spill response, and rapidly report any spill to the appropriate agencies.
3. Applicators shall maintain on-site (near herbicide storage and loading equipment) appropriate initial spill-response items (e.g., absorbent materials).

Mitigation Measure 3.2-3.2

In order to minimize off-target spray drift and impacts to water quality from herbicide application, aerial pesticide application by helicopter shall be preferred (over fixed wing aircraft). In addition, all appropriate, standard BMPs for aerial application of pesticides shall be followed, including but not limited to, the following:

1. Applicators shall develop an application plan--including maps of the Project site showing general spotter and flight plans with application areas clearly indicated--to be approved by the Lead Agency, before any application of herbicides.
2. Applicators shall adhere strictly to proper mixing and application guidelines as presented on herbicide labels and in product instructions.
3. Application of herbicides on levee vegetation shall not take place by air and otherwise avoided unless necessary, when it would be executed using spot application techniques.
4. Herbicide application by air shall only take place during the in-water work window from July 1 to October 31 of any one year, in order to reduce potential impacts to migrating fish species of concern.
5. Applicators shall maintain records of herbicide applications—including dates, times, weather conditions, amount of herbicide applied, problems experienced, etc.— in addition to or as required by federal, state, and/or local agencies.

6. Spraying shall at all times be halted when flying over levees, adjacent waterbodies (e.g., Miner Slough, DWSC), and agricultural fields.
7. Aerial application would occur only during light winds, non-gusty, relatively cool weather conditions.
8. Application would involve the use of appropriate spray nozzles, nozzle configurations, and nozzle orientations that minimize atomization of herbicide mixtures and production of fine droplets that tend to drift.
9. Herbicide tanks would not be operated at excessively high pressures.
10. If conditions require the use of aerial spray by fixed-wing aircraft, pilots shall be instructed to include an appropriate spray buffer (in addition to the width of the levee) where, to the extent possible, no herbicides would be directly applied (subject to overriding safety concerns).

Impact significance

Less than significant with mitigation

Impact 3.2-4: Short-term construction-related effects on water temperature in adjacent waterbodies due to dewatering activities

Applicable Basin Plan water quality objectives stipulate that natural receiving water temperatures shall not be altered unless beneficial uses would not be adversely affected, with a maximum increase of no more than 5°F (Table 3.2-13). Prospect Island monthly average water temperatures appear to be similar or slightly cooler than those measured in Miner Slough at the HWY 84 Bridge for the period 2011-2013 (Table 3.2-13). Although there may be daily variations in water temperature within Prospect Island that could affect water temperature at the dewatering discharge point, the dewatering pump discharges are only expected to be a small fraction of the daily tidal flow range within Miner Slough (Section 3.1.1 Hydrology – Setting). Therefore, the potential for warming of the receiving waters from dewatering activities is expected to be minimal and there would be no impact.

Table 3.2-13. Monthly Measured Water Temperatures in Miner Slough and Prospect Island 2011–2013

Month	Average Temperature (°F)		
	Miner Slough Measured[a]	Prospect Island Measured	Difference
Jan	47.3	46.0	1.3
Feb	50.1	49.7	0.4
Mar	53.3	53.4	-0.1
Apr	59.6	59.2	0.4
May	64.4	63.7	0.7
Jun	68.0	66.2	1.9
Jul	70.5	67.4	3.1
Aug	70.8	67.6	3.2
Sep	68.5	66.4	2.1
Oct	62.6	61.6	1.0
Nov	55.4	54.3	1.1
Dec	48.4	47.1	1.3

a Continuous (15-minute intervals) *in situ* measurements from CDEC HWB station located in Miner Slough at the Highway 84 Bridge. http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=HWB

b Continuous (15-minute intervals) *in situ* measurements from the Prospect Island Tide Station located at the pump house in the southeast corner of the north property (CDEC station B91400), http://www.water.ca.gov/waterdatalibrary/docs/Hydstra/index.cfm?site=B91400

Impact significance

No impact

Impact 3.2-5: Long-term effects on salinity in waterbodies near Prospect Island

Breaching the levees in the north and south properties and breaching the interior cross levee would subject much of Prospect Island to daily tidal flows and inundation. This would alter hydrology in the vicinity of Prospect Island and could affect salinity in nearby waterbodies. Salinity increases are of concern to various municipalities, industry, agriculture, and resource agencies in the Delta that depend on availability of freshwater to maintain existing beneficial uses.

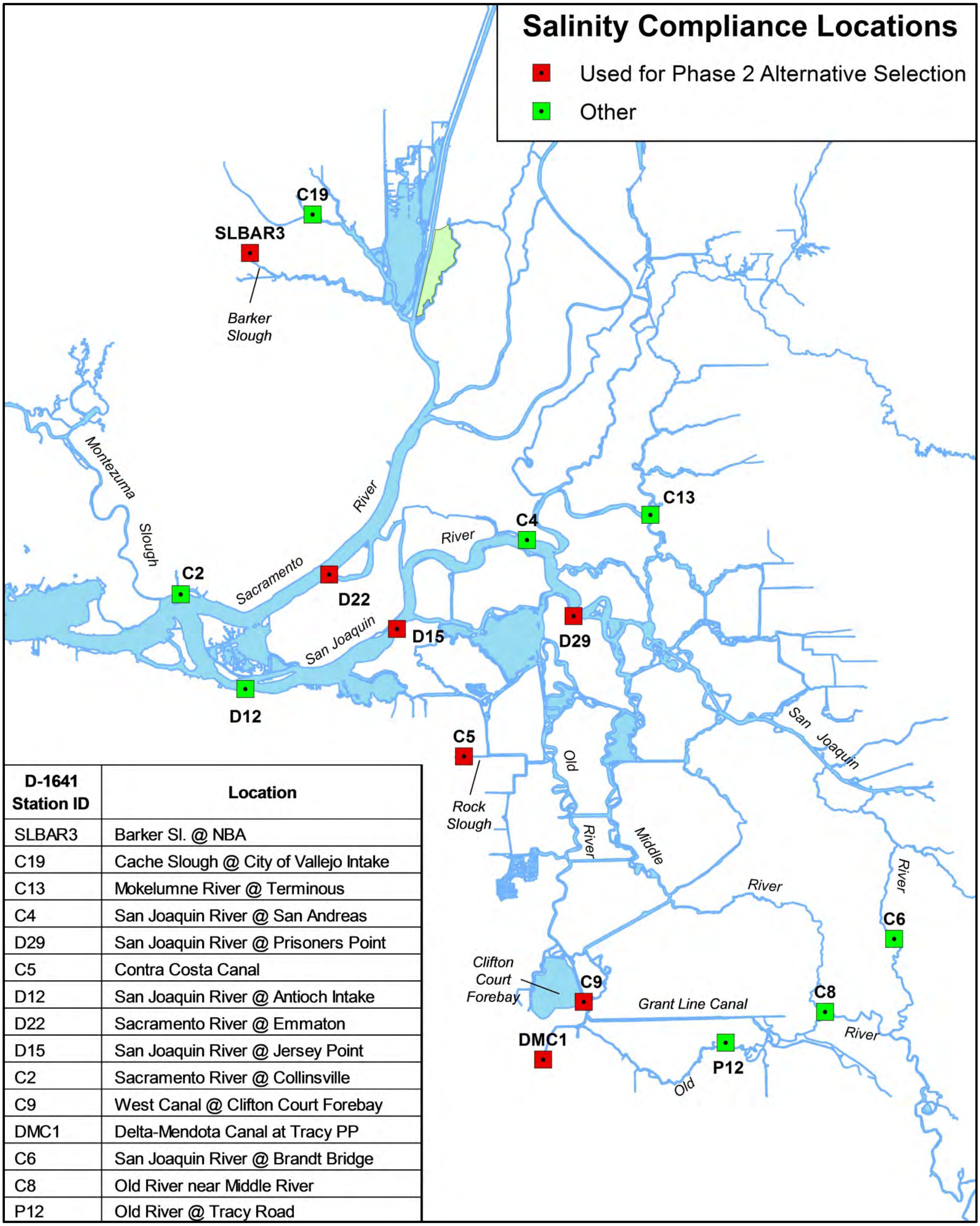
Phase 2 hydrodynamic modeling for the Prospect Island Tidal Habitat Restoration Project was conducted to support selection of final restoration alternatives, inform environmental impact assessments, and inform engineering design of the selected alternative (Appendix D in WWR and SWS 2014). The modeled conceptual alternatives included a variety of configurations with varying numbers and locations of weirs and breaches along both Miner Slough and the DWSC, one of which was similar to the Proposed Project (Phase 2 “Alt 26”).

Salinity changes were modeled under both dry and below normal hydrologic conditions at seven compliance locations established by the State Water Resources Control Board Water Rights Decision 1641 (D-1641) (SWRCB 2000) with the primary goal of determining potential for non-compliance with water quality objectives and Proposed Project effects on salinity intrusion in the Delta. Supplemental to this analysis, salinity impacts of the Proposed Project and three alternatives (including the No Project alternative) were modeled at eight additional compliance locations to support environmental impact analyses (Table 3.2-14, Figure 3.2-6).

Table 3.2-14. SWRCB D-1641 Compliance Monitoring Stations Used to Evaluate the Possibility of Increased Salinity Under the Proposed Project

D-1641 Station ID	Location	Designated Beneficial Uses[1]
SLBAR3	Barker Slough at the North Bay Aqueduct	MUN, IND
D22	Sacramento River at Emmaton	AGR
D15	San Joaquin River at Jersey Point	AGR, WARM, COLD, MIGR, SPWN, WILD
D29	San Joaquin River at Prisoners Point	WARM, COLD, MIGR, SPWN, WILD
C5	Contra Costa Canal at Rock Slough	MUN, IND
C9	West Canal at Clifton Court Forebay Intake	AGR, MUN, IND
DMC1	Delta-Mendota Canal at Tracy Pumping Plant	AGR, MUN, IND
C2	Sacramento River at Collinsville	AGR, WARM, COLD, MIGR, SPWN, WILD
C13	Mokelumne River at Terminous	AGR
C4	San Joaquin River at San Andreas	AGR
C6, C8, P12	South Delta locations	AGR
D12	San Joaquin River at Antioch Intake	MUN, IND
C19	Cache Slough at City of Vallejo Intake	MUN, IND

1 Designated Beneficial Uses defined in Table 3.2-7



D-1641 Station ID	Location
SLBAR3	Barker Sl. @ NBA
C19	Cache Slough @ City of Vallejo Intake
C13	Mokelumne River @ Terminous
C4	San Joaquin River @ San Andreas
D29	San Joaquin River @ Prisoners Point
C5	Contra Costa Canal
D12	San Joaquin River @ Antioch Intake
D22	Sacramento River @ Emmaton
D15	San Joaquin River @ Jersey Point
C2	Sacramento River @ Collinsville
C9	West Canal @ Clifton Court Forebay
DMC1	Delta-Mendota Canal at Tracy PP
C6	San Joaquin River @ Brandt Bridge
C8	Old River near Middle River
P12	Old River @ Tracy Road

Figure 3.2-6

SWRCB D-1641 Compliance Locations Used for Salinity Impacts Modeling

Compliance for stations with agriculture, fish, and/or wildlife beneficial use designations (D22, D15, D25, D29, C9, DMC1, C2, C13, C4, C6, C8, and P12; see Table 3.2-14) was determined using the modeled EC values and comparing against the 14-day running average of mean daily EC objective during the compliance period set by D-1641 (SWRCB 2000). Compliance for stations with municipal and industrial beneficial use designations (SLBAR3, C5, C9, DMC1, D12, and C19; see Table 3.2-14) was determined by computing the mean daily value of chloride concentration from the modeled EC values and comparing the calculated value to the chloride objective (maximum = 250 mg/L; Table 3.2-8). Phase 2 modeling results showed that under the Proposed Project salinity at the modeled compliance locations in the vicinity of Prospect Island met EC compliance objectives, with consistent decreases at Barker Slough (SLBAR3). During summer and fall when Delta outflows are lowest, results showed less than 1% increase in salinity (EC values ranging from 0 to 32 uS/cm) for the majority of the modeled compliance locations. At a small number of stations, modeled salinity increases were relatively greater, with a maximum increase of approximately 7.8% (EC increase of approximately 30 uS/cm) in 2009 (dry water year type) at D-1641 compliance monitoring station C4, located on the San Joaquin River to the south and east of the Project site. However, these results did not result in non-compliance with D-1641 salinity standards. Therefore, based on the Phase 2 modeling results, projected salinity changes under the Proposed Project would be minor and would not result in substantial adverse effects on beneficial uses of water. There would be a less than significant effect on salinity in nearby waterbodies.

Impact significance

Less than significant

Impact 3.2-6: Long-term effects on water temperature within Prospect Island and in nearby waterbodies

Breaching the levees in the north and south properties and breaching the interior cross levee would subject much of Prospect Island to daily tidal flows and inundation. This would alter hydrology in the vicinity of Prospect Island and could affect water temperature within Prospect Island and in nearby waterbodies.

For Delta Smelt and Chinook Salmon, desirable water temperatures are less than 68°F (20°C). Water temperatures in the range of 68 to 77°F (20–25°C) are considered to be sub-optimal, whereby fish may be stressed physiologically, and reproductive, foraging, and other behaviors may be detrimentally affected (Myrick and Cech Jr. 2001, Appendix B in WWR and SWS 2014). Temperatures above

77°F (25°C) are considered lethal to eggs, fry, and/or adults. If water temperatures are supportive for these sensitive species, it is generally assumed that they are adequate for other wildlife related beneficial uses of water.

During the conceptual planning phase of the Proposed Project, Phase 2 modeling of water temperatures was conducted using the aforementioned sub-optimal and lethal thresholds and compared with actual measured water temperatures for 2010 (Appendix B in WWR and SWS 2014). Results for the model configuration most similar to the Proposed Project indicated that waterbodies near and within Prospect Island would not experience sub-optimal or lethal water temperatures during March through May 2010. However, during June through September 2010, actual and modeled sub-optimal water temperatures were exhibited in nearby waterbodies. No lethal temperatures were exhibited (Table 3.2-15 and Table 3.2-16). For waterbodies near Prospect Island, including Miner Slough (HWB), South Miner Slough, Cache Slough at Miner Slough, and Cache Slough at Ryer Island (RYR), the number of days exhibiting actual sub-optimal water temperatures ranged 79–86 out of 122 days, with only slight reductions projected under the Proposed Project (Table 3.2-15). At two sites (South Miner Slough and Cache Slough (RYR)), slightly fewer (1–2) days of sub-optimal temperatures were projected under the Proposed Project as compared with actual conditions, suggesting the potential for slight improvements in seasonal water temperatures under the Proposed Project. Within Prospect Island, Phase 2 modeling results indicated a lesser number of days of sub-optimal water temperatures than in nearby waterbodies (i.e., 69–80 out of 122 days, see Table 3.2-16).

Table 3.2-15. Numbers of Actual and Modeled Days (June to September 2010) Exhibiting Sub-optimal Water Temperatures for Selected Waterbodies near Prospect Island

Waterbody	Existing Conditions	Phase 2 Alt 26
Miner Sl. (HWB)	79 out of 122	79 out of 122
South Miner Sl.	83 out of 122	81 out of 122
Cache Sl. (at Miner Sl.)	86 out of 122	86 out of 122
Cache Sl. (RYR)	86 out of 122	85 out of 122

Source: (Appendix B in WWR and SWS 2014)

Table 3.2-16. Numbers of Modeled Days (June to September 2010) with Sub-optimal Water Temperatures for Selected Habitats on Prospect Island

Habitat	Phase 2 Alt 26
Channels	70 out of 122
Open Water	80 out of 122
Emergent Vegetation	69 out of 122

Source: (Appendix B in WWR and SWS 2014)

Based on the Phase 2 modeling results, projected changes in seasonal water temperatures (June through September) under the Proposed Project in nearby waterbodies would be minor and would not result in substantial adverse effects on beneficial uses of water, in particular the support of habitat for sensitive fish species. Conversely, model results indicate the potential for slight improvements in seasonal water temperatures under the Proposed Project. There would be a beneficial effect on long-term water temperature.

Impact significance

Beneficial

Impact 3.2-7: Long-term effects on primary productivity and dissolved organic carbon (DOC) within and near Prospect Island

The Proposed Project, through the enhancement of subtidal habitat and development of intertidal wetlands, would support beneficial levels of primary productivity on Prospect Island, with subsequent export to the greater Delta as a food source for fisheries (WWR and SWS 2014). During the conceptual planning phase of the Proposed Project, particle tracking simulations were used to model selection for various algal species as well as potential export of primary productivity for a variety of project configurations with varying numbers and locations of breaches and weirs along Miner Slough. One of the modeled conceptual alternatives was similar to the Proposed Project (Phase 1 “Alt 23”).

Based on estimated particle exposure times within Prospect Island, model results indicate that the Proposed Project may produce high primary productivity with greater abundance of diatom-based phytoplankton than blue-green algal species associated with harmful blooms (WWR and SWS 2014). Model results also suggest that on a continuing basis, productivity from the Proposed Project would be exported primarily to the surrounding Cache Slough complex sites in the lower Sacramento River and the Sacramento DWSC, with lower export potential to Cache Slough and Miner Slough. Overall, export would generally be dominated by preferred diatom-based algal species with high food value to pelagic species (SWS and WWR 2012).

Algae produced at the restored Project site could also be a source of dissolved organic carbon (DOC) to nearby waterbodies. DOC is a potentially significant problem for water treatment facilities because elevated concentrations can result in the formation of carcinogenic disinfection by-products during chlorination. The intake for the State Water Project's NBA is located in the western Cache Slough Complex at the upper end of Barker Slough, and roughly nine river miles from the southern end of Prospect Island. Treated water is delivered to Napa, Vallejo, and Benicia municipalities.

Phase 1 modeling simulated potential changes in DOC at the Barker Slough Pumping Plant intake using conservative particle tracking models for 2010 hydrology (Appendix G in SWS and WWR 2012). Modeling results indicated that a small amount (0.9–1.6%) of the total simulated DOC generated at the Project site was subsequently transported to Barker Slough. Overall, simulated DOC increases at the Barker Slough Pumping Plant intake for the period of July 2010 were largely influenced by increased tidal exchange provided by the Proposed Project, which resulted in Sacramento River water from Miner Slough, Steamboat Slough, and the lower Sacramento River being drawn north into Lindsey Slough on flood tide.

Based on the Phase 1 modeling results, simulated changes in potential DOC increases in nearby waterbodies under the Proposed Project would be low. This would not result in substantial adverse effects on beneficial uses of water, in particular municipal drinking water supply at the Barker Slough Pumping Plant. There would be a less than significant effect on long-term DOC concentrations.

Impact significance
Less than significant

Impact 3.2-8: Long-term effects on methylmercury production, bioaccumulation, and export

The Proposed Project would convert existing perennially flooded freshwater emergent marsh to tidal freshwater emergent marsh, which may affect the rate of methylmercury production and degree of bioaccumulation in higher trophic level organisms resident at the Project site and may result in subsequent transport of methylmercury to downstream waterbodies. If methylmercury production increases, and depending on the magnitude of the increase, this could result in adverse, few, or no effects on public health or environmental receptors due to elevated methylmercury concentrations in the tissue of fish, birds, mammals, and humans that consume contaminated organisms.

Factors controlling the production and bioaccumulation of methylmercury and its ability to be transported from tidal wetlands into downstream waterbodies are complex and not yet fully understood (Section 3.2.1). Inorganic forms of mercury are present in Prospect Island sediments and levee soils due to upstream historical mining practices in the Sierra Nevada range and the steady passive transport of inorganic mercury downstream through foothill and Valley tributaries to aquatic environments in the Bay-Delta system (Domagalski 1998, 2001; Rytuba 2000; Choe and Gill 2003; Choe et al. 2003; Weiner et al. 2003). In addition, relatively high levels of suspended sediments in the Project vicinity may contain total mercury from these upstream sources.

Based upon the CALFED Science Program Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) conceptual model of methylmercury production, habitat flooding frequency corresponds with a methylmercury gradient, from relatively low methylmercury concentrations in the overlying water column of perennially flooded habitats (e.g., open water areas), low to moderate concentrations in habitats that flood frequently and do not fully dry between inundation events (e.g., low elevation tidal marsh), and potentially higher concentrations in areas that flood less frequently and dry out between inundation events (e.g., seasonal floodplains or wetlands and high elevation tidal marsh) (Alpers et al. 2008).

Restoration of tidal action to the site would result in the conversion of existing perennially flooded emergent marsh (i.e., associated with low to moderate methylmercury concentrations) to open water habitat (i.e., associated with low methylmercury concentrations). The Proposed Project would create a small area of infrequently flooded habitat (i.e., associated with higher methylmercury concentrations) between MHW and MHHW on the land-side of the perimeter levees. Within these habitats, the Proposed Project would accumulate sediment under existing sediment supply conditions, with deeper areas of the Project site accreting more rapidly than those at higher elevations (see also Impact 3.5-2). Maximum sediment deposition would likely occur near the breaches and in the deeper central portion of Prospect Island. Although the incoming sediments have the potential to contain mercury from upstream sources, sediment deposition in the infrequently flooded habitat associated with higher methylmercury production is expected to be low. Overall, the expected habitat changes would increase the area of open water habitat and would therefore support lower methylmercury production in and export from the restored Project site as compared to existing conditions.

With respect to bioaccumulation, patterns in biosentinel fish data collected in the Delta suggest that perennially flooded wetlands would likely present a relatively low risk of mercury bioaccumulation through transfer from obligate wetland species residing or feeding in the wetlands to the greater Delta food web. Sites experiencing episodic flooding of normally dry soils exhibited much higher methylmercury in biosentinel fish tissue, an observation that was particularly evident following seasonal flooding events at sites located on the perimeter of the Bay-Delta. In contrast, vegetated, perennially flooded wetlands such as sites in the nearby Cache Slough Complex (i.e., Liberty Island, Little Holland Tract) showed statistically lower biosentinel fish mercury than adjacent non-vegetated sites (Melwani et al. 2007).

Consistent with the Delta Methylmercury TMDL (Section 3.2.1 Water Quality – Setting), DWR and CDFW are currently engaged in compliance control studies for methylmercury and total mercury loads from several tidal wetlands in the Delta and Suisun Marsh. These studies are investigating (a) the levels of production, import, and export of methylmercury at and from tidal and open water habitats in the northern Delta, and (b) potential mechanisms to alleviate, if necessary, methylmercury production and export from these habitats. For example, although several recent studies have suggested that methylmercury water column concentrations in tidal wetlands can be elevated (e.g., Bergamaschi et al. 2012, 2011, Windham-Myers et al. 2009, Mitchell and Gilmour 2008), these studies are based predominantly on data from salt marshes, with limited consideration of non-tidal freshwater wetlands and agricultural wetlands (e.g., rice fields) and no instances of freshwater tidal wetlands, such as the Proposed Project. Further, a recent study in Chesapeake Bay indicates that tidal marshes may not be large contributors when considered on the basis of mercury loading rather than water column concentrations (Mitchell et al. 2012). The DWR and CDFW compliance control studies would contribute to knowledge that can be used to better understand the potential contributions of freshwater tidal wetlands to Delta methylmercury loading and to inform future restoration project planning efforts such as the Proposed Project. Updates to the RWQCB regarding these activities are currently anticipated in 2015 and 2018.

Overall, it is anticipated that the small increase in the area of infrequently flooded habitat between MHW and MHHW on the land-side of the perimeter levees would potentially result in increased methylmercury production which would be partially offset by the increases in open water habitat associated with lower production and bioaccumulation potential. Because the Project site would be open to tidal action, any methylmercury produced in the infrequently flooded habitat would be exported to surrounding waterways. However, given the small degree of anticipated methylmercury production from infrequently flooded habitats at the Project site, and the scientific uncertainty regarding the degree to which freshwater tidal wetlands contribute to Delta methylmercury loading now and in the future, this would be a less than significant impact.

Impact significance

Less than significant

Impact 3.2-9: Potential effects on groundwater quality

Surface water on Prospect Island is separated from surrounding groundwater flows by an average 25-ft thick, low-permeability clay layer underlying the Project site (DWR 2014b). As any water quality effects on surface waters due to the Proposed Project would be less than significant or less than significant with mitigation, and as there is little to no direct connection for surface water to interact with groundwater at the Project site, the Proposed Project would not affect groundwater quality.

Impact significance

No impact

3.3 Aquatic Biological Resources

This section covers the aquatic biological resources likely to occur on or near the Project site, which could be affected by the Proposed Project. Aquatic biological resources include resident and anadromous fish occurring in water bodies within and adjacent to the Project site (in the Cache Slough Complex and north Delta), invertebrate communities in these water bodies, and aquatic and riparian habitat used by these aquatic organisms.

The impact analysis is based on expert opinion in combination with current sampling efforts including CDFW IEP monitoring programs, and DWR Environmental Monitoring Program; a review of relevant environmental documents including the Lower Yolo Ranch EIR (SFCWA 2013), Lindsey Slough

MND (CDFW 2013), and Dutch Slough EIRs (DWR and California State Coastal Conservancy 2008, 2014); and professional publications.

3.3.1 Setting

Environmental setting

Fish resources

The CSC, Miner Slough, and Prospect Island provide aquatic habitat for at least 44 fish species (Table 3.3-1), all of which have the potential to occur in the Proposed Project area (Sommer et al. 2003). Of the 17 native fish species potentially occurring near Prospect Island, 11 have been designated as special-status species under the federal ESA or CESA:

- Pacific Lamprey (*Entosphenus tridentata*; federal species of concern).
- River Lamprey (*Lampetra ayresii*; state species of special concern).
- North American Green Sturgeon (*Acipenser medirostris;* southern Distinct Population Segment [DPS]; federally threatened, state species of special concern).
- Sacramento Splittail (*Pogonichthys macrolepidotus*; state species of special concern).
- Delta Smelt (*Hypomesus transpacificus*; federally threatened, state endangered).
- Longfin Smelt (*Spirinchus thaleichthys*; state threatened).
- Steelhead (*Oncorhynchus mykiss*; federally threatened).
- All four runs of Chinook Salmon (*Oncorhynchus tshawytscha*) occurring in the Central Valley: spring-run (state and federally threatened), fall-run (state and federal species of concern), late fall-run (state and federal species of concern), and winter-run (state and federally endangered).

Additional details on each of the special-status fish species, including status, life history, and habitat requirements, are provided in the sections below.

Table 3.3-1. Fishes Occurring in the Sacramento-San Joaquin Delta and Potentially Occurring at the Project Site[1]

Common Name	Scientific Name	Native/Introduced	Federal/State Status[2]
PETROMYZONTIDAE—LAMPREYS			
Pacific Lamprey	*Entosphenus tridentata*	Native	SC/--
River Lamprey	*Lampetra ayresii*	Native	--/SSC
ACIPENSERIDAE—STURGEONS			
North American Green Sturgeon	*Acipenser medirostris*	Native	T/SSC
White Sturgeon	*Acipenser transmontanus*	Native	--/--
CLUPEIDAE—HERRINGS			
Threadfin Shad	*Dorosoma petenense*	Introduced	--/--
American Shad	*Alosa sapidissima*	Introduced	--/--
CYPRINIDAE—MINNOWS			
Common Carp	*Cyrpinus carpio*	Introduced	--/--
Fathead Minnow	*Pimephales promelas*	Introduced	--/--
Golden Shiner	*Notemigonus crysoleucas*	Introduced	--/--
Goldfish	*Carassius auratus*	Introduced	--/--
Sacramento Hitch	*Lavinia exilicauda*	Native	--/--
Red Shiner	*Cyprinella lutrensis*	Introduced	--/--
Sacramento Blackfish	*Orthodon microlepidotus*	Native	--/--
Sacramento Pikeminnow	*Ptychocheilus grandis*	Native	--/--
Sacramento Splittail	*Pogonichthys macrolepidotus*	Native	--/SSC
CATOSTOMIDAE—SUCKERS			
Sacramento Sucker	*Catostomus occidentalis*	Native	--/--
ICTALURIDAE—BULLHEAD CATFISH			
Black Bullhead	*Ameiurus melas*	Introduced	--/--
Brown Bullhead	*Ameiurus nebulosus*	Introduced	--/--
Channel Catfish	*Ictalurus punctatus*	Introduced	--/--
White Catfish	*Ameiurus catus*	Introduced	--/--
OSMERIDAE—SMELTS			
Delta Smelt	*Hypomesus transpacificus*	Native	T/E
Longfin Smelt	*Spirinchus thaleichthys*	Native	--/T

Common Name	Scientific Name	Native/Introduced	Federal/State Status[2]
Wakasagi	*Hypomesus nipponensis*	Introduced	--/--
SALMONIDAE—SALMON AND TROUT			
Chinook Salmon (spring-run)	*Oncorhynchus tshawytscha*	Native	T/T
Chinook Salmon (fall-run and late fall-run)	*Oncorhynchus tshawytscha*	Native	SC/SSC
Chinook Salmon (winter-run)	*Oncorhynchus tshawytscha*	Native	E/E
Steelhead (Central Valley)	*Oncorhynchus mykiss*	Native	T/--
ATHERINOPSIDAE—SILVERSIDES			
Mississippi Silverside	*Menidia beryllina*	Introduced	--/--
POECILIIDAE—LIVEBEARERS			
Western Mosquitofish	*Gambusia affinis*	Introduced	--/--
GASTEROSTEIDAE—STICKLEBACKS			
Threespine Stickleback	*Gasterosteus aculeatus*	Native	--/--
COTTIDAE—SCULPINS			
Pacific Staghorn Sculpin	*Leptocottus armatus*	Native	--/--
Prickly Sculpin	*Cottus asper*	Native	--/--
MORONIDAE—STRIPED BASSES			
Striped Bass	*Morone saxatilis*	Introduced	--/--
CENTRARCHIDAE—SUNFISH AND BASSES			
Black Crappie	*Pomoxis nigromaculatus*	Introduced	--/--
Bluegill	*Lepomis macrochirus*	Introduced	--/--
Green Sunfish	*Lepomis cyanellus*	Introduced	--/--
Largemouth Bass	*Micropterus salmoides*	Introduced	--/--
Redear Sunfish	*Lepomis microlophus*	Introduced	--/--
Smallmouth Bass	*Micropterus dolomieu*	Introduced	--/--
Spotted Bass	*Micropterus punctatus*	Introduced	--/--
Warmouth	*Lepomis gulosus*	Introduced	--/--
White Crappie	*Pomoxis annularis*	Introduced	--/--
PERCIDAE—PERCHES			
Bigscale Logperch	*Percina macrolepida*	Introduced	--/--
EMBIOTOCIDAE –SURFPERCHES			
Tule Perch	*Hysterocarpus traskii*	Native	--/--

Common Name	Scientific Name	Native/Introduced	Federal/State Status[2]
GOBIIDAE—GOBIES			
Yellowfin Goby	*Acanthogobius flavimanus*	Introduced	--/--
Shimofuri Goby	*Tridentiger bifasciatus*	Introduced	--/--

1 Likelihood of occurrence is based on documented observations of species during surveys conducted by DWR in 2009, presence and extent of known habitat, and proximity to known occurrences in CNDDB (CDFW 2014c), and CDFW and USFWS fish survey programs.
2 T—Listed as threatened under the State (CESA) or Federal (ESA) Endangered Species Act
E—Listed as endangered under CESA or ESA
SC—Considered a Federal Species of Concern
SSC—Considered a State Species of Special Concern

Although fish sampling does not regularly occur within Prospect Island, CDFW performed electrofishing surveys in August 2013 and January 2014 to determine the types of fish present on the site (Table 3.3-2). The two sampling efforts used different equipment, water temperatures were drastically different, and culvert operation differed, so the surveys cannot be directly compared; however, results serve as an indication of the dominant species currently within Prospect Island. Of the thirteen species collected within the island, three were native species (Sacramento Blackfish, Prickly Sculpin, and Hitch) and these were relatively abundant compared to the non-native species. No special-status fish species were found within Prospect Island. Overall, the island appears to host native and sport fishes important to fisheries and the health of the Delta.

Table 3.3-2. Representative Fish Species Collected Using Electrofishing in Prospect Island During August 2013 and January 2014

Species	Native/Invasive	CPUE (fish/hour) August 2013	CPUE (fish/hour) January 2014
American Shad	Invasive	49	0
Sacramento Blackfish	Native	24	7
Largemouth Bass	Invasive	23	13
Goldfish	Invasive	21	1
Common Carp	Invasive	18	1
Golden Shiner	Invasive	17	0
Sacramento Hitch	Native	9	1
Redear Sunfish	Invasive	2	0
Black Crappie	Invasive	2	3
Mosquitofish	Invasive	2	0
Prickly Sculpin	Native	2	0
Black Bullhead	Invasive	1	3

Special-status fish

Pacific Lamprey

Adult Pacific Lampreys are the largest lampreys in California. They are distributed from Japan, through Alaska, and south to Baja California. Like other lampreys in California, Pacific Lampreys are anadromous and spawn in gravelly streams, including tributaries of the San Francisco Estuary and the Central Valley. There are no surveys that regularly monitor or catch Pacific Lampreys, and the extent of their distribution within Miner Slough is unknown. Because juveniles and larvae rear in silty backwater habitats, it is unlikely that Miner Slough would provide adequate habitat for anything but adult and juvenile migration (Moyle 2002).

Adults spend their predatory phase of life in the ocean where they parasitize a variety of fish species. Upstream migration to spawning habitat begins as early as January; however most upstream migrants arrive between March and late June. Ammocoetes, the larval stage of lampreys, are washed downstream to silty backwaters where they feed on algae and microorganisms until they metamorphose into juvenile macropthalmia. Upon completion of metamorphosis, downstream migration occurs during high outflow events.

The ecology of the Pacific Lamprey has not been extensively studied. Populations appear to have declined based on anecdotal observations, but Pacific Lampreys still occur in most of their native areas (Moyle 2002). Pacific Lampreys are considered a federal species of concern.

River Lamprey

The River Lamprey is an anadromous species found in coastal streams from north of Juneau, Alaska to the San Francisco Estuary and Central Valley (Moyle 2002). Individuals are recovered annually from the state and federal fish collection facilities in the South Delta. In California, most records are from streams in the lower portion of the Sacramento-San Joaquin River system, but their distribution is poorly understood because they have not been studied extensively. There are no surveys that regularly monitor or catch River Lampreys, and the extent of their distribution within Miner Slough is unknown. Because juveniles and larvae rear in silty backwater habitats, it is unlikely that Miner Slough would provide adequate habitat for anything but adult and juvenile migration (Moyle 2002).

Adults migrate into freshwater in fall after spending only 3–4 months in the ocean. Spawning takes place in February through May in gravelly riffles of tributary streams. Ammocoetes remain in the substrate in silty backwaters and eddies of streams where they feed on algae and microorganisms. River Lampreys are presumed to remain as ammocoetes in freshwater for 3–5 years before emigrating to the ocean in late spring (Moyle 2002).

Population trends for River Lampreys in California are not known, but are presumed to have declined as the amount of spawning and rearing habitat in the lower reaches of rivers has been reduced (Moyle 2002). River Lampreys are considered a Watch List species among the California Species of Special Concern (Moyle et al. 1995). Watch List species are those that occupy much of their native range, but are now less widespread and abundant.

Green Sturgeon

The North American Green Sturgeon is an anadromous species that primarily inhabits estuarine and coastal waters, but migrates into freshwater to spawn. The species occurs in rivers from British Columbia south to the San Joaquin River (Jackson and Van Eenennaam 2013) and in the Pacific Ocean from the Bering Sea to Baja California, Mexico (Moyle 2002). There are two populations, each of which qualifies as a species under the ESA: (1) the Northern DPS, consisting of populations in coastal watersheds northward of and including the Eel River; and (2) the Southern DPS consisting of populations south of the Eel River (Klimley et al. 2007). Currently the only known spawning population in the Southern DPS occurs in the Sacramento River. Spawning migrations take place from February through July, with a peak spawning period of mid-April to mid-June (Moyle 2002).

Preferred spawning habitat is often characterized by deep, swiftly flowing water over substrate of large cobble where eggs are broadcast and fertilized externally. Larvae presumably hatch in 7–9 days, depending on temperature, and juveniles spend from 1 to 4 years in fresh and estuarine waters before dispersing into the ocean at lengths of 1 to 2.5 ft (Beamesderfer and Webb 2002). Juveniles begin moving downstream toward the ocean primarily in summer, with outmigrant abundance in the lower Sacramento River and Delta likely peaking from June through November (Adams et al. 2002). Both adult and juvenile Green Sturgeons are benthic feeders, consuming shrimp, amphipods, clams, other invertebrates, and small fish (Moyle 2002). Green Sturgeons are periodically entrained into the state and federal fish collection facilities in the south Delta; individuals taken at the facilities are juveniles, generally in the 28 to 38 cm Fork Length size range (Adams et al. 2002).

Little is known about the life history of Green Sturgeons (Klimley et al. 2007), and few studies catch them regularly. The CDFW Striped Bass Study and Sturgeon Study catch Green Sturgeons (CDFW 2014a), but those surveys are limited to Suisun and San Pablo Bay. Miner Slough is a tributary to the Sacramento River and thus considered critical habitat, but sightings of Green Sturgeons in Miner Slough are limited and unsubstantiated (Adams et al. 2002).

The southern DPS was listed in 2006 as threatened pursuant to the federal Endangered Species Act (NMFS 2006b). Threats to the population cited as reasons for listing the southern DPS of Green Sturgeons include loss of spawning habitat, adult migration barriers, insufficient flow, increased water temperatures, water diversions, non-native species, poaching, pesticides and heavy metals, and over fishing. Green Sturgeons are also considered a California Species of Special Concern by CDFW (Moyle et al. 1995). Critical habitat was designated in 2009 and includes all waters of the legal Delta (NMFS 2009b).

Sacramento Splittail

Sacramento Splittail are endemic to the Central Valley and San Francisco Estuary. In the San Joaquin River they were once distributed as far south as Friant, but their current breeding range in the San Joaquin basin appears to be much more restricted (Moyle 2002). In the Sacramento River, they have recently been observed as far upstream as Red Bluff Diversion Dam; however, the upstream extent of their spawning migrations is unknown (Feyrer et al. 2005). When flooded, the Yolo Bypass may provide important spawning and rearing habitat, suggesting that Miner Slough may at times be used as spawning and rearing habitat for Splittail (Moyle 2002). When they are not spawning, Splittail are often most abundant in sloughs of Suisun Marsh and the northern portion of the Delta. The CDFW 20-mm survey regularly catches larval Splittail in Miner Slough and throughout the Cache Slough Complex, though not in high numbers (Table 3.3-3).

The USFWS Juvenile Fish Monitoring program regularly catches Splittail at their sampling stations in Suisun bay and along the Sacramento River (Marshall 2005), and the DWR Yolo Bypass Fish Monitoring Program catches large numbers throughout the year in the toe drain (Table 3.3-3). However, there are no stations within Miner Slough and since Splittail are benthic, many sampling methods are inefficient.

Their tolerance of high salinities, a wide range of temperatures, and low dissolved oxygen levels (<1 mg/L) makes them particularly well suited to slow-moving sections of rivers and sloughs (Moyle 2002). Individuals can live as long as eight years, with both males and females becoming sexually mature at the end of their second year. Mature Splittail migrate through the northern Delta and lower Sacramento River to spawning areas from January through April and spawn any time from late February to early July (Moyle 2002). Their preferred spawning habitat appears to be inundated floodplains where they spawn over submerged plants and debris, to which their eggs adhere. Embryos hatch in 3–7 days, depending on temperature, and juveniles rear in the floodplain until waters recede or until a late spring flood pulse triggers emigration. Year-class-strength of Splittail is positively correlated to the extent of floodplain inundation and tends to be higher during wetter years (Moyle 2002).

Splittail were listed by USFWS as a threatened species in 1999 because of concerns about apparent long-term abundance declines, but re-analysis of abundance data led Splittail to be de-listed in 2003 (USFWS 2003). However, CDFW still considers Splittail to be a Species of Special Concern (Moyle et al. 1995).

Table 3.3-3. Adult and Juvenile Sacramento Splittail at Stations in the Vicinity of Prospect Island 2011–2013

Location	Average Monthly Catch[1]											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Miner Slough[2] (larval)	N/A	N/A	0	0	1	1	0	N/A	N/A	N/A	N/A	N/A
Lindsey Slough[3]	1	0	0	0	0	1	1	0	0	0	0	0
Cache Slough at Miner[3]	0	0	0	1	0	1	0	0	0	0	0	1
Rio Vista[3,4]	1	1	2	1	1	1	1	1	0	0	0	0
Chipps Island[3,4]	10	7	7	10	6	3	1	30	22	4	2	49
Deep Water Ship Channel[3]	0	1	2	0	0	0	1	0	0	0	0	0
Yolo Bypass Toe Drain[5]	16	184	109	332	1643	3384	56	9	1	3	3	21
Total	27	193	120	344	1651	3391	60	40	23	7	5	71

1 Includes data from beach seines, trawls, rotary screw traps, and fyke traps (P. Poirier, CDFW, pers. comm., 2015)
2 The Miner Slough data are from CDFW 20-mm Survey 2011 and contains data from a 20-mm larval fish net (P. Poirier, CDFW, pers. comm., 2015)
3 Data are from CDFW Spring Kodiak Trawl, Summer Townet, and Fall Midwater programs 2011-2013 (P. Poirier, CDFW, pers. comm., 2015)
4 Data are from USFWS Juvenile Fish Monitoring Program (http://www.fws.gov/stockton/jfmp/)
5 Data are from Yolo Bypass Fish Monitoring Program 2011-2013 (P. Poirier, CDFW, pers. comm., 2015)

Delta Smelt

Delta Smelt are endemic to the Sacramento-San Joaquin Delta, occurring primarily below Isleton on the Sacramento River and below Mossdale on the San Joaquin River. They are tolerant of a wide range of salinities, but adults are mostly found in water of 2-7 ppt salinity; however, spawning and rearing mostly occurs in freshwater (Moyle 2002, Sommer and Mejia 2013).

Delta Smelt typically rear in shallow (<3 m), open waters of the Delta, San Pablo Bay, Suisun Bay, and Suisun Marsh where they prey on zooplankton, primarily copepods, cladocerans, and amphipods (Moyle 2002). The CDFW 20-mm survey, targeting juvenile Delta Smelt, frequently catches Delta Smelt at sampling stations in Miner Slough, and historically the North Bay Aqueduct Larval Fish Survey occasionally caught high numbers of Delta Smelt at sampling locations in Miner Slough. The species is generally considered to have a 1-year, semelparous life cycle, with most individuals spawning and then dying at the end of their first year. Spawning migrations begin in September or October when Delta Smelt move to the upper portions of the Delta where they spawn between February and July (Table 3.3-4). Delta Smelt spawn in sloughs and shallow edge habitats in the upper Delta, in the Sacramento River above Rio Vista, Montezuma Slough near Suisun Bay, lower Napa River, and possibly Suisun Slough in Suisun Marsh (Moyle 2002).

Declining populations led the USFWS to list Delta Smelt as a federal threatened species in 1993 (USFWS 1993b). Critical habitat was designated for Delta Smelt in 1994 and consists of all water and all submerged lands below ordinary high water in the entire legal Delta, including waters surrounding Prospect Island (USFWS 1994). The USFWS considers Shallow Water Habitat, which they define as all waters between MHW and 3-meters below MLLW Mark, to be a special element of their habitat (USFWS 2004). The Delta Smelt was also listed in 1993 as a threatened species pursuant to the CESA and uplisted to endangered on January 20, 2010. Abundance indices for Delta Smelt, calculated from IEP monitoring, have been a primary tool in tracking changes in relative abundance for the species. During the 10 years prior to 2005, the Delta Smelt Index had experienced some of the lowest numbers on record, prompting concern that a “step change” had occurred in the population of Delta Smelt and other pelagic-oriented species in the Delta (Armor et al. 2005).

Table 3.3-4. Adult and Juvenile Delta Smelt at Stations in the Vicinity of Prospect Island 2011-2013

Location	Average Monthly Catch[1]											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Miner Slough[2] (larval)	N/A	N/A	2	4	31	22	1	N/A	N/A	N/A	N/A	N/A
Lindsey Slough[3]	2	2	48	3	16	1	2	13	0	0	0	2
Cache Slough at Miner[3]	2	1	14	3	2	4	2	0	1	0	0	0
Rio Vista[3,4]	0	0	13	1	1	1	0	0	0	0	0	0
Chipps Island[3,4]	27	17	13	11	5	13	23	50	36	29	7	30
Deep Water Ship Channel[3]	98	64	26	31	17	30	7	2	0	1	4	2
Yolo Bypass Toe Drain[5]	7	17	30	3	9	31	2	0	0	1	1	0
Total	136	101	146	56	81	102	37	65	37	31	12	7

1 Includes data from beach seines, trawls, rotary screw traps, and fyke traps (P. Poirier, CDFW, pers. comm., 2015)
2 The Miner Slough data are from CDFW 20-mm Survey 2011 and contains data from a 20-mm larval fish net (P. Poirier, CDFW, pers. comm., 2015)
3 Data are from CDFW Spring Kodiak Trawl, Summer Townet, and Fall Midwater programs 2011-2013 (P. Poirier, CDFW, pers. comm., 2015)
4 Data are from USFWS Juvenile Fish Monitoring Program (http://www.fws.gov/stockton/jfmp/)
5 Data are from Yolo Bypass Fish Monitoring Program 2011-2013 (P. Poirier, CDFW, pers. comm., 2015)

Longfin Smelt

Longfin Smelt is an estuarine species occurring in the San Francisco Estuary, including the Delta, as well as other estuaries along coastal Northern California. Their distribution extends northward to Prince William Sound, Alaska and the southern extent of their distribution is represented by a single individual collected in Monterey Bay. In the San Francisco Estuary, Longfin Smelt populations are concentrated in Suisun, San Pablo, and North San Francisco bays, and rarely occur upstream of Rio Vista or Medford Island in the Delta (Moyle 2002). The CDFW IEP sampling efforts have occasionally caught adult Longfin Smelt at sampling stations throughout the Cache Slough Complex (Table 3.3-5), but most are captured as larvae during high tides and low flows. An annual abundance index is generated using data from the CDFW Fall Midwater Trawl Survey and Bay-Study Program (Armor et al. 2005).

The distribution of Longfin Smelt depends on salinity and water temperature, as well as on the life stage of individual fish. While Longfin Smelt can tolerate salinities ranging from nearly pure seawater to fresh water, individuals seem to prefer salinities in the range of 15–30 ppt after completing early life stages

(Moyle 2002). They often concentrate in San Pablo Bay in April-June and become more dispersed by late summer. Individuals mature by the end of their second year of life and migrate upstream near Rio Vista to spawn in fresh water during fall or winter. In the Delta, Longfin Smelt spawn over sand or gravel substrates, rocks, and aquatic plants at water temperatures of 44–58.1 ˚F (7–14.5 ˚C) (Moyle 2002).

A strong positive correlation has been established between Delta outflow and Longfin Smelt abundance the following year (Moyle 2002). The Longfin Smelt is considered threatened by CDFW because of its declining abundance in the Delta. Low abundance-indices for Longfin Smelt prompted concern that a “step change” had occurred in the population of Longfin Smelt and other pelagic-oriented species in the Delta (Armor et al. 2005). Since 2005, Longfin Smelt abundances have remained low according to IEP abundance indices (CDFW 2014b).

Table 3.3-5. Average Monthly Catch of Adult and Juvenile Longfin Smelt at Stations Within and Near Miner Slough, 2011-2013

Location	Average Monthly Catch[1]											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Miner Slough[2] (larval)	N/A	N/A	3	1	0	0	0	N/A	N/A	N/A	N/A	N/A
Lindsey Slough[3]	0	0	0	1	0	0	0	0	0	0	0	0
Cache Slough at Miner[3]	0	0	0	0	0	1	0	0	0	0	0	0
Rio Vista[3,4]	0	0	0	0	0	0	0	0	0	0	0	0
Chipps Island[3,4]	106	10	150	3	4	36	0	0	0	0	0	143
Deep Water Ship Channel[3]	1	0	0	1	0	1	0	0	0	0	0	1
Yolo Bypass Toe Drain[5]	1	0	0	0	1	1	0	0	0	0	0	0
Total	108	10	153	6	5	39	0	0	0	0	0	144

1 Includes data from beach seines, trawls, rotary screw traps, and fyke traps (P. Poirier, CDFW, pers. comm., August 2015)
2 The Miner Slough data are from CDFW 20-mm Survey 2011 and contains data from a 20-mm larval fish net (P. Poirier, CDFW, pers. comm., August 2015)
3 Data are from CDFW Spring Kodiak Trawl, Summer Townet, and Fall Midwater programs 2011-2013 (P. Poirier, CDFW, pers. comm., August 2015)
4 Data are from USFWS Juvenile Fish Monitoring Program (http://www.fws.gov/stockton/jfmp/)
5 Data are from Yolo Bypass Fish Monitoring Program 2011-2013 (P. Poirier, CDFW, pers. comm., August 2015)

Central Valley Steelhead

Steelhead are the anadromous, or migratory, form of coastal Rainbow Trout (*Oncorhynchus mykiss irideus*), which have extremely variable and flexible life history patterns. Steelhead are not considered to be taxonomically distinct from populations of non-anadromous Rainbow Trout with which they co-occur, but rather they share a common gene pool (Garza and Pearse 2008) and are capable of interbreeding. Coastal Rainbow Trout were originally native to permanent streams along the coast of California, including the Sacramento and San Joaquin rivers and their tributaries (Moyle 2002). In the Central Valley, Steelhead enter freshwater beginning in August with migration peaking in late September through October and then hold until flows are adequate to allow them to enter tributaries for spawning (Moyle 2002).

While there are no sampling programs within Miner Slough focused on Steelhead, the USFWS Juvenile Fish Monitoring Program and DWR Yolo Bypass Fish Monitoring Program sample in locations near Miner Slough or have a connection to Miner Slough (Table 3.3-6). Miner Slough is within the Critical Habitat boundary as designated by the USFWS, and while it is possibly used as a migratory route, the extent to which Steelhead use Miner Slough is unknown.

The Central Valley Steelhead DPS was listed by the NMFS as threatened in 1998 and the listing status was reaffirmed in 2006 (NMFS 2006a). Critical Habitat for Central Valley Steelhead was originally designated in 2000, but in response to a lawsuit was rescinded in 2002 along with critical habitat for 18 other salmon and steelhead Evolutionarily Significant Units (ESU). Critical habitat for Central Valley Steelhead was re-designated in 2005 and includes the Delta (NMFS 2005).

Table 3.3-6. Monthly Catch of Central Valley Steelhead at Stations Along the Sacramento River and Near Miner Slough, 2011–2013

Location	Average Monthly Catch[1]											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Garcia Bend[5]	13	29	5	2	2	0	0	0	0	0	0	0
Steamboat Slough[5]	0	0	0	0	0	0	0	0	0	0	0	0
Ryde[4,5]	0	1	0	0	0	0	0	0	0	0	0	0
Rio Vista[4,5]	1	2	1	0	0	0	0	0	0	0	0	0
Chipps Island[2,4]	4	5	4	2	1	0	0	0	0	0	0	0

Location	Average Monthly Catch[1]											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Deep Water Ship Channel[4]	0	1	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Yolo Bypass Toe Drain[5]	0	0	2	0	1	0	0	0	0	0	0	0
Total	18	38	12	5	4	0	0	0	0	0	0	0

1 Includes data from beach seines, trawls, rotary screw traps, and fyke traps (P. Poirier, CDFW, pers. comm., August 2015)
2 The Miner Slough data are from CDFW 20-mm Survey 2011 and contains data from a 20-mm larval fish net (P. Poirier, CDFW, pers. comm., August 2015)
3 Data are from CDFW Spring Kodiak Trawl, Summer Townet, and Fall Midwater programs 2011-2013 (P. Poirier, CDFW, pers. comm., August 2015)
4 Data are from USFWS Juvenile Fish Monitoring Program (http://www.fws.gov/stockton/jfmp/)
5 Data are from Yolo Bypass Fish Monitoring Program 2011-2013 (P. Poirier, CDFW, pers. comm., August 2015)

Chinook Salmon

The distribution of Chinook Salmon in the Pacific Ocean depends upon ocean temperatures and, off the coast of North America, is generally from Kotzebue Sound, Alaska to south of Monterey Bay, California. Spawning runs of anadromous Chinook Salmon in California occur in rivers of the north and central coast and those draining the Central Valley. The southernmost spawning populations occur in the San Joaquin and Kings rivers of the Central Valley (Moyle 2002). There are four distinct runs of Chinook Salmon in the Central Valley, all of which spend part of their life cycle in the Delta: Sacramento River winter-run Chinook Salmon, Central Valley spring-run Chinook Salmon, Central Valley fall-run Chinook Salmon, and Central Valley late fall-run Chinook Salmon. Adults of all four runs pass through the Delta on their upstream spawning migrations and juveniles spend varying amounts of time rearing in the Delta. Winter-run and spring-run Chinook Salmon populations in the Central Valley are considered distinct ESUs that qualifies as species under the ESA. The fall-run and late fall-run populations together compose a third ESU of Chinook Salmon in the Central Valley.

The USFWS Juvenile Fish Monitoring Program, Yolo Bypass Fish Monitoring Program, and CDFW Spring Kodiak Trawl monitor juvenile Chinook Salmon outmigration throughout the Delta; however, Miner Slough is not a monitoring site in any of these programs. An acoustic study (Vogel 2008) released tagged juvenile salmon on the Sacramento River and showed evidence of salmon utilizing the Project site; of the salmon that reached Sutter and Steamboat sloughs, 30% were detected entering Sutter Slough, and then 59% of those were subsequently detected in lower Miner Slough. Thus, while exact numbers of salmon are unknown, Miner Slough is presumed to be used by all runs of

Chinook Salmon to some degree. Due to the potential presence of salmon (Table 3.3-7), Miner Slough is designated Critical Habitat for the listed runs of Chinook Salmon, and EFH for all runs of Chinook Salmon. Therefore, projects proposed within EFH that are permitted, funded, or undertaken by a federal agency are also regulated by NMFS. Essential Fish Habitat is defined in the Magnuson-Stevens Fishery Conservation and Management Act as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Table 3.3-7. Average Monthly Catch of Juvenile Chinook Salmon of All Runs at Stations Along the Sacramento River and Near Miner Slough, 2011-2013

Location	Average Monthly Catch[1]											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Garcia Bend[5]	532	167	229	923	403	10	1	1	0	1	22	85
Steamboat Slough[5]	1	125	7	22	0	1	0	0	0	0	0	0
Ryde[4,5]	2	21	19	9	28	0	0	0	0	0	0	8
Rio Vista[4,5]	3	3	4	6	29	0	0	0	0	0	0	9
Chipps Island[2,4]	5	3	12	351	515	72	5	6	4	2	1	19
Deep Water Ship Channel[4]	0	0	0	1	7	0	0	0	0	0	0	0
Yolo Bypass Toe Drain[5]	4	5	35	75	19	2	0	0	0	1	1	1
Total	546	323	306	1386	1000	85	6	7	4	4	24	123

1 Includes data from beach seines, trawls, rotary screw traps, and fyke traps (P. Poirier, CDFW, pers. comm., August 2015)
2 The Miner Slough data are from CDFW 20-mm Survey 2011 and contains data from a 20-mm larval fish net (P. Poirier, CDFW, pers. comm., August 2015)
3 Data are from CDFW Spring Kodiak Trawl, Summer Townet, and Fall Midwater programs 2011-2013 (P. Poirier, CDFW, pers. comm., August 2015)
4 Data are from USFWS Juvenile Fish Monitoring Program (http://www.fws.gov/stockton/jfmp/)
5 Data are from Yolo Bypass Fish Monitoring Program 2011-2013 (P. Poirier, CDFW, pers. comm., August 2015)

Sacramento River winter-run Chinook Salmon

Winter-run Chinook Salmon are unique to the Sacramento River. They typically migrate upstream as sexually immature fish in winter and spring and then spawn in early summer. Winter-run migrants enter the estuary as early as December; however the peak migration occurs from January through March. Presently, their spawning habitat is restricted to the Sacramento River below Shasta Reservoir, where hypolimnetic, cool dense waters below the thermocline, releases are used to maintain river temperatures of 10-15˚C. Juveniles spend 5-10 months in streams followed by an intermediate period in the San Francisco estuary, including the Delta (Moyle 2002).

In 1989, declines in the abundance of returning adults led the State Fish and Game Commission to list winter-run Chinook Salmon as endangered (CDFG 2005a), while the NMFS initially listed winter-run Chinook as a threatened species. In 1994 the federal listing status of winter-run Chinook Salmon was reclassified to endangered. In 1993 Critical Habitat was designated for winter-run Chinook Salmon to include the Sacramento River from Keswick Dam to Chipps Island at the western extent of the Delta (NMFS 1993); the Critical Habitat designation encompasses the Project site.

Central Valley spring-run Chinook Salmon

Spring-run Chinook Salmon enter the San Francisco Bay as sexually immature fish in spring or early summer and migrate to tributaries of the Sacramento River, where they hold in deep, cold pools for several months prior to spawning in early fall. Spring-run migrants enter the estuary as early as March; however the peak migration occurs from May through June. Juveniles typically rear in streams for 3-15 months before moving downstream, primarily as smolts that move rapidly through the Delta (Moyle 2002). However, some spring-run Chinook in Butte Creek emigrate as fry and, therefore, the abundance of spring-run Chinook rearing in the Delta may be greater in some years (Moyle 2002).

Historically, spring-run Chinook Salmon migrated far upstream in larger tributaries of the Sacramento and San Joaquin rivers. Due to dam construction, however, spring-run Chinook were eliminated from the San Joaquin River drainage and their spawning populations were greatly reduced in the Sacramento River drainage. Currently, Central Valley spring-run Chinook Salmon are supported primarily by spawning populations in Deer, Mill, and Butte creeks with much smaller runs in streams such as Big Chico, Antelope Creek, and Beegum creeks (CDFG 2005b). Following restoration of lower Clear Creek, spring-run Chinook are once again returning to this historical spawning ground (CDFG 2005b). Spring-run salmon also spawn in the mainstem Sacramento, Yuba, and Feather rivers, but are likely hybridized with fall-run Chinook Salmon.

Spring-run Chinook Salmon in the Central Valley were listed as state and federally threatened in 1999 by the State Fish and Game Commission and NMFS (1999). Critical Habitat for Central Valley spring-run Chinook includes the Delta to the western edge of Sherman Island (NMFS 2005).

Central Valley fall-run Chinook Salmon

Fall-run Chinook Salmon migrate from the ocean in late summer and early fall as sexually mature fish and spawn within days or weeks of reaching their spawning grounds in the lowland reaches of larger rivers and their tributaries (Moyle 2002). Fall migrants enter the estuary as early as June; however peak migration occurs from September through October. Juveniles emerge from gravel in spring and move downstream within a few months to rear in mainstem rivers or estuaries. Central Valley fall-run Chinook Salmon have the longest estuarine rearing period of the four Chinook Salmon runs in the Central Valley (Moyle 2002).

The fall run is currently the most abundant Chinook Salmon run in the Central Valley (Azat 2014). Currently, fall-run Chinook in the Sacramento and San Joaquin rivers are supplemented by hatcheries on Battle Creek and the Feather, American, Mokelumne, and Merced rivers. Straying by fall-run Chinook, presumably of hatchery origin, has resulted in runs becoming established in Guadalupe River and Coyote Creek in South San Francisco Bay (Moyle 2002). The combined fall-run and late fall-run Chinook Salmon populations are part of a single ESU, which is a federal species of concern and a California Species of Special Concern.

Central Valley late fall-run Chinook Salmon

Late fall-run Chinook salmon typically migrate upstream from the ocean from October through February and hold for 1–3 months prior to spawning in January through March (Moyle et al. 1995). Juveniles spend 7–13 months in freshwater prior to outmigration. No reliable run-size estimates are available since 1994 because the gates of Red Bluff Diversion Dam have been left open during the migration period to allow free passage (Cramer and Demko 1996). Late fall-run Chinook are a California Species of Special Concern and, as part of a single ESU with fall-run Chinook, are a federal species of concern.

Aquatic Invertebrates and Plankton

Algae and diatoms can live in the water column (planktonic), on the bottom of aquatic habitat (benthic), or on submerged plants (epiphytic). Aquatic invertebrates can also be associated with the water column or benthos; those aquatic invertebrates that are found in or on the sediment or other materials lining channels and open water habitat are called benthic invertebrates, and those more associated with the water column are called zooplankton. Linked together, these groups play vital ecological roles in aquatic environments and make up the food web supporting fish production in the Delta. Phytoplankton and epiphytic algae are primary producers in the food web, capturing solar energy and nutrients to become food for benthic invertebrates and zooplankton, which in turn, are preyed upon by fish, which in turn, are the prey of larger fish or birds.

Phytoplankton plays an important role in primary production, as indicated by chlorophyll production in aquatic systems, particularly in the Delta. As the main source of zooplankton food, phytoplankton anchors the food chain and can greatly affect higher trophic levels (Carpenter et al. 1985). Changes in phytoplankton community assemblage from one composed largely of diatoms toward a greater proportion of green and blue-green (cyanobacteria) algae can influence the zooplankton community in a way that inhibits the survival of certain species of fish. Over the past few decades this is believed to have led to the decline in numerous species in the Delta, including Delta Smelt (Armor et al. 2005). Increases in turbidity and ammonium are a few factors thought to contribute to the suppression of primary production in the Delta (Jassby et al 2002, Orsi and Mecum 1996).

Mysid shrimp and amphipods are the primary food source for many young-of-the-year fish occurring in the Delta, while smaller zooplankton like calanoid copepods *Eurytemora affinis* and *Pseudodiaptomus forbesi* serve as the primary food source for larger invertebrates and small fish (Moyle 2002). The introduction of invasive invertebrate species is thought to have contributed to regime changes in the dominant zooplankton of the Delta. For decades the non-native *Pseudodiaptomus*, non-native *Eurytemora*, and native mysid shrimp *Neomysis mercedis* were the dominant food sources for fish in the Delta; more recently, non-native copepods like *Limnoithona*, have become increasingly abundant (Armor et al. 2005). Despite their abundance, they may not be readily available as a food source for fish and may be affecting the growth and survival of Delta fish (Mecum 2005).

The CDFW 20-mm Survey is the only known survey that samples zooplankton in Miner Slough. Currently the two stations are sampled every two weeks between March and July; however, those two stations were recently added in 2008 (CDFW 2014b). The most recent data available (2012) show a distinct difference between Miner Slough zooplankton species composition and abundance when compared to other nearby stations in the Cache Slough Complex such as Calhoun Cut, Lindsey Slough, West Cache Slough, and the DWSC (Table 3.3-8). Miner Slough seems to be dominated by more benthic and epiphytic invertebrates that thrive better in cooler, calmer waters, including: Cladocera (*Bosmina* sp., *Ceriodaphnia* sp., other *Cladocera*), cyclopoid copepods, and rotifers. Miner Slough also lacks the abundance of calanoid copepods seen at nearby stations; calanoid copepods are an important food resource for fish. Limited zooplankton sampling by CDFW within Prospect Island shows an aquatic environment dominated by planktonic algae, benthic and epiphytic invertebrates, and insect larvae, demonstrating a habitat more similar to a eutrophic lacustrine habitat (Pinto-Coelho 1998).

Table 3.3-8. Average Zooplankton Density (Zooplankton/deciliter) in Prospect Island and Adjacent Water Bodies During March–July 2012

Species	Calhoun Cut	Lindsey Slough	West Cache Slough	Deep Water Ship Channel	Miner Slough – Hall Island	Prospect Island—North Property
CALANOID COPEPOD						
Eurytemora	96	43	15	18	17	27
Pseudodiaptomus	6,682	5,278	5,507	4,713	99	101
Sinocalanus	11,374	15,451	2,913	3,440	23	21
Diaptomus	19	22	27	21	48	42
CYCLOPOID COPEPOD						
Cyclopoid copepod	2,780	2,105	1,059	1,203	2,182	2,183
Nauplii	2,477	2,865	789	515	47	108
CLADOCERA						
Bosmina	5,253	3,436	584	482	1,955	2,040
Ceriodaphnia	198	112	68	106	451	396
Daphnia	2,534	2,159	193	114	215	195
Diaphanosoma	1,597	2,317	39	18	86	70
Other Cladocera	434	115	154	207	1,045	1,163
ROTIFER						
Other Rotifer spp.	432	708	42	46	484	517

Data from CDFW 20-mm Survey (P. Poirier, CDFW, pers. comm., August 2015)

Nonnative invasive aquatic species

Asian clam

The Asian clam (*Corbicula fluminea*) invaded United States waters in 1938 and has since spread to 38 states. It has been known to cause damage to pipes and canals, completely alter benthic substrates and species compositions, and compete with native species for limited resources (Sousa et al. 2008). Their rapid growth rates, high fecundity rates, ability to self-fertilize, and high filtering rates have assisted in the widespread invasion of riverine and lentic environments.

The Asian clam exhibits a wide range of reproductive strategies; they have been known to reproduce both sexually and asexually and can be oviparous (egg producing), ovoviviparous (egg brooding). This in combination with a high fecundity and multiple spawns per year results in rapid colonization and growth. While their densities are not as large as *Corbula amurensis* in the Delta, their water column clearance rates are some of the highest per biomass (Cummings and Graf 2010). Because their clearance rates are so high, shallow water habitats are particularly vulnerable to disruptions in the aquatic food web.

The Asian clam is present in the Cache Slough Complex as evidenced by shell sightings and habitat preference; however, distribution and population density within Miner Slough and on Prospect Island is unknown. The DWR Environmental Monitoring Program collects benthic samples throughout the Delta, but the extent of their north Delta sampling normally stops at Rio Vista. Regular sampling shows abundant populations of Asian clam throughout the south Delta and up the Sacramento River through Rio Vista where their density is highest. A brief special study by DWR's Environmental Monitoring Program sampled throughout Cache Slough up to Liberty Island and shows that Asian clam abundance in Cache Slough is comparable to that of other locations throughout the Delta (Table 3.3-9).

Table 3.3-9. DWR Environmental Monitoring Program Catch of Asian clam During 2011

Asian clam Abundance (number/sample)			
Station[1]	**May**	**October**	**Total**
Cache Slough	246	49	295
Lower Sherman Island	258	74	342
Rio Vista	392	455	847
Twitchell	118	201	319
Old River	134	388	522

1 Stations were sampled using benthic grab samples.

Aquatic habitat

Prospect Island has a history of flooding; levees failed and flooded 29 times in the last century (DWR and CDFW 2014). By 2008, Prospect Island was once again dry, and the only connection with the surrounding waterways was a culvert located on Miner Slough that led to the northern portion of Prospect Island. From 2008 to late 2013, the culvert was damaged, ultimately leading to the flooding that occurs today. The erosion of a repair site on Miner Slough resulted in a leak and subsequent flooding of the southern portion of Prospect Island as well. Limited tidal exchange occurs through the culvert and leaky repair site. However, since November 2013 the culvert was repaired, eliminating tidal action that would occur on the northern portion of Prospect Island. Within Prospect Island, aquatic habitat is a mix of non-tidal perennial aquatic (open water) and wetlands (Section 3.4.1 Wetland and Terrestrial Biological Resources – Setting). Tidal Waters of the U.S. surround Prospect Island, including adjacent sloughs, shipping channels, wetlands, and open water habitat. Prospect Island is bordered by Miner Slough to the east, Cache Slough and the Miner Slough Wildlife Area to the south, and the DWSC to the west (Figure 2.1-2).

Legal and regulatory setting

This section addresses only laws and regulations that directly affect fish and other aquatic resources. Laws and regulations pertaining to habitat conditions that indirectly affect these resources, such as hydrology and water quality, are mentioned here but described in detail in their relevant sections.

Management of anadromous fish is the responsibility of NMFS, whereas management of non-anadromous fish and other aquatic biological resources in the Proposed Project area is the responsibility of USFWS at the federal level and CDFW at the state level. CDFW also acts as state trustee for aquatic species. These three agencies, either independently or in collaboration with other state and federal agencies, implement numerous fish management and restoration plans and initiatives.

Federal laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following federal laws and regulations.

Federal Endangered Species Act

The federal ESA (16 United States Code [USC] Section 1531 *et seq*.) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The law requires federal agencies (and other public agencies seeking approval, funding, and/or permitting through federal agencies), in consultation with USFWS and/or the NMFS, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species.

Section 9 of the federal ESA and its regulations prohibit the take of federally listed species. An incidental take permit under ESA Section 10(a) or federal consultation under Section 7 of the ESA is required if the Proposed Project might affect a federally listed species.

ESA compliance for SWP and CVP Coordinated Operations Criteria and Plan

The operation of the Central Valley Project (CVP) and the State Water Project (SWP) is described in the existing Operations Criteria and Plan (OCAP). Updated in 2004, the OCAP provides details of the coordinated operations of the CVP and SWP based on historical data, and serves as a starting point for planning water project operations in the future. Under the federal ESA, USFWS and NMFS must produce formal BiOps analyzing the impact of OCAP implementation on ESA-listed species, and thus pertains to the Proposed Project.

Currently, five species in the Proposed Project area (the winter-run and spring-run Chinook Salmon, Delta Smelt, North American Green Sturgeon, and Central Valley Steelhead) are listed under the ESA. USFWS released an OCAP BiOp for Delta Smelt on December 15, 2008. This BiOp includes the requirement within its Reasonable and Prudent Alternatives, among others, of developing 8,000 ac of tidal restoration.

NMFS released its latest OCAP BiOp on June 4, 2009, concluding that CVP and SWP operations would jeopardize the continued existence of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook Salmon, threatened Central Valley Steelhead, and threatened Southern DPS of the North American Green Sturgeon. The NMFS BiOp includes by reference the 8,000-ac tidal restoration requirement contained in the USFWS BiOp. Because restoration of tidal habitat would provide access for salmonid rearing at Prospect Island, the Project would also be consistent with RPA I.6.1 of the NMFS Salmonid BiOp for SWP/CVP operations.

Magnuson-Stevens Fishery Conservation and Management Act

The federal Magnuson-Stevens Fishery Conservation and Management Act (16 USC Section 1801 *et seq.*) is the primary law governing marine fisheries management in the United States. The purpose of this federal law is sevenfold: conserve fishery resources, support enforcement of international fishing agreements, promote fishing in line with conservation principles, provide for the implementation of fishery management plans to achieve optimal yield, establish regional fishery management councils to steward fishery resources, develop underutilized fisheries, and protect EFH.

The act requires federal agencies to consult with NMFS when a project has the potential to adversely affect EFH. States are not required to consult with NMFS; however, NMFS is required to develop EFH conservation recommendations for any state agency activity that would affect EFH. Similar in concept to critical habitat of the federal ESA, EFH protection measures recommended by NMFS or a regional fisheries management council are advisory and not prescriptive (NMFS 1998). The Proposed Project area is located in the region identified as EFH for Pacific salmon, which includes all runs of Chinook Salmon.

Clean Water Act

The Proposed Project would need a Section 401 certification from the CVRWQCB to demonstrate that the Proposed Project would comply with all applicable water quality standards, including meeting standards associated with levels of methylmercury, suspended materials, dissolved oxygen, and chemicals that could be affected by construction equipment during construction, maintenance, and/or operations (see Section 3.2 Water Quality for more information).

State laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

California Endangered Species Act

The state counterpart to the federal ESA, CESA (CFG Code Section 2050 *et seq.*) has similar, but distinct requirements and goals. CESA requires state agencies to coordinate with the CDFW to ensure that state-authorized or state-funded actions do not jeopardize a state-listed species. The state list of species classified as rare, threatened, or endangered does not necessarily correspond with the federal list of threatened and endangered species.

The Proposed Project could potentially affect state-listed species and thus must be in compliance with CESA, as applicable.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne) (California Water Code Title 23) protects California waters. The act gives the State Water Resources Control Board, through the CVRWQCB, the authority to regulate discharges of waste, including dredged or fill material, to any state waters within its jurisdiction. Biological beneficial uses of state waters are subject to regulation through various means, including conditions attached to the certification of federal CWA (Section 401) authorizations (See Section 3.2 Water Quality for more information).

Streambed Alteration Agreement

Under Section 1600 - 1616 of the CFG Code, CDFW regulates activities that would alter the flow, bed, channel, or bank of streams and lakes. The limits are as the "… bed, channel or bank of any river, stream, or lake designated by the department in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit ..." (Section 1601). Undertaking stream-altering activities that may adversely affect fish or wildlife would require an applicant to enter into an agreement with CDFW for authorization for up to five years. The Proposed Project would require a streambed alteration agreement prior to construction.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Solano County General Plan (2008)

The Resources section of the Solano County General Plan identifies goals, policies, and implementation actions to protect natural, cultural, and open space resources. Under the current General Plan, Prospect Island is considered agricultural land within a resource conservation overlay. Under goal RS.G-4, the County intends to preserve, conserve, and enhance valuable open space lands that provide wildlife habitat. The Proposed Project is supported by six goals, 11 policies, and two implementation programs within the Solano County General Plan. Some of the key policies applicable to the Proposed Project on aquatic resources are listed in Table 3.3-10.

Table 3.3-10. Solano County General Plan: Goals and Policies Relevant to Aquatic Biological Resources

General Plan Policy/Goal/Program	General Plan Policies and Implementation Programs
RS.P-1	Protect and enhance the county's natural habitats and diverse plant and animal communities, particularly occurrences of special-status species, wetlands, sensitive natural communities, and habitat connections.
RS.P-7	Preserve and enhance the diversity of habitats in delta marshes to maintain these unique wildlife resources.
RS.P-9	Encourage restoration of historic marshes to wetland status, either as tidal marshes or managed wetlands. When managed wetlands are no longer used for waterfowl hunter, restore them as tidal marshes.

3.3.2 Significance criteria

Criteria for determining significant impacts on aquatic biological resources are based upon the *State CEQA Guidelines* (Appendix G) and professional judgment. In the evaluation that follows, a potential impact to aquatic biological resources would be significant if the implementation of the Proposed Project would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW, the USFWS, or the NMFS.
- Have a substantial adverse effect on any riparian habitat or other sensitive aquatic community identified in local or regional plans, policies, or regulations, or by the CDFW, the USFWS, or the NMFS.
- Interfere substantially with the movement of any native resident or migratory fish, or impede the use of native fishes nursery sites.
- Conflict with any local policies or ordinances protecting aquatic resources.
- Conflict with the provisions of an adopted Habitat Conservation Plan (e.g., Bay Delta Conservation Plan [BDCP]), Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.3.3 Impacts and mitigation

Impact 3.3-1: Short-term loss and degradation of aquatic habitat from construction-related activities

The potential for the Proposed Project to result in construction-related loss or degradation of aquatic habitat was evaluated in terms of:

- the type and magnitude of the area affected;
- the nature and duration of effects; and
- how such habitat alterations could affect resident and migratory fish species and other populations and communities of aquatic life.

Short-term, temporary impacts to aquatic habitat would result from the temporary repair of the south property levee and mechanical dredging of the Miner Slough spur channel to increase tidal exchange capacity of the channel.

The repair of the south property levee would facilitate the dewatering of Prospect Island as needed during the construction period. The temporary levee repair would involve installation of a sheet pile wall with 2:1 slope rock fill on both sides of the wall. The fill would temporarily cover approximately 0.1 ac of aquatic habitat in the Miner Slough spur channel. The eliminated habitat is considered EFH for spring and winter-run Chinook Salmon and Critical Habitat for Green Sturgeon southern DPS, Central Valley Steelhead, Spring-run Chinook Salmon, and Delta Smelt. However, this impact would be temporary as the rock slope would be removed upon completion of the Proposed Project. The habitat would be available to fish immediately following the construction period, along with the newly created tidal habitat within Prospect Island.

Dredging would involve the removal of 47,000 cubic yards of soil from 2,400 linear feet of the dead-end tidal channel along the southern end of Miner Slough. Approximately 5 ac of bottom habitat would be disturbed near the southern breach location as a result of dredging operations. The habitat that would be disturbed is considered EFH for spring and winter-run Chinook Salmon and Critical Habitat for Green Sturgeon southern DPS, Central Valley Steelhead, Spring-run Chinook Salmon, and Delta Smelt. The removal of bottom sediment would impact the benthic community and disturb food and habitat resources that may be beneficial to fish. However, this impact is considered temporary as the benthic community would reestablish and provide the same benefit to fish prior to dredging. There would be no net change in aquatic habitat as a result of dredging operations.

In summary, the Proposed Project would not impact special-status fish, other native fish, or their habitat to an extent that would cause adverse individual or population-level effects because impacts by the Proposed Project would be short-term and temporary. The aquatic habitat effected by the levee repair and dredging activities would be available upon completion of each activity with no net loss in habitat.Therefore, impacts would be less than significant.

Impact significance

Less than significant

Impact 3.3-2: Long-term conversion and enhancement of aquatic habitat

The potential effects of long-term conversion and enhancement of aquatic habitat by the Proposed Project was evaluated in terms of:

- the type and magnitude of the area affected;
- a comparison of the amount and type of habitat lost or altered to the amount and type of habitat created by the Proposed Project; and
- how such habitat alterations could affect resident and migratory fish species and other populations and communities of aquatic life.

Long-term, permanent impacts to aquatic habitat would result from the breaching of the Miner slough levees. Breaching of the Miner Slough levees would permanently eliminate 1,060 linear feet (0.2 miles, Table 2.2-3) of aquatic shoreline habitat and shaded riverine aquatic (SRA) habitat within the immediate vicinity of the two breaches along the west levee of Miner Slough. This would remove approximately 4% of the total 5.2 miles of SRA habitat along Miner Slough, which is considered EFH for spring and winter-run Chinook Salmon and Critical Habitat for Green Sturgeon southern DPS, Central Valley Steelhead, Spring-run Chinook Salmon, and Delta Smelt. Riparian EFH that would be removed at each of these locations consists of scrub and woodland trees that may provide thermal refuge by means of shade and a source of terrestrial insects to the channel.

It is the ultimate goal of the Proposed Project to increase the quality and quantity of salmonid rearing habitat in and around Prospect Island. The Proposed Project would create up to 472 ac of tidal perennial aquatic and 1,053 ac of tidal freshwater emergent wetland habitats (Table 2.2-2) including access to over 9 miles of SRA habitat along interior levees. The Proposed Project would benefit special-status fish by expanding access to habitat that would develop into critical habitats for winter- and spring-run Chinook Salmon, Steelhead, Green Sturgeon, and Delta Smelt and EFH for winter- and spring-run Chinook Salmon. Therefore, the Proposed Project would result in a substantial benefit to these aquatic biological resources.

Impact significance

Beneficial

Impact 3.3-3: Short-term direct construction-related injury or mortality of fish

The potential for the Proposed Project to result in construction-related injury or mortality of aquatic organisms was evaluated in terms of:

- the timing and duration of construction;
- the spatial scale and nature of disturbance;
- the equipment to be used and construction approach implemented; and
- the organisms likely to occur during construction.

Mortality or direct injury to special-status fish and other native fish may occur as a result of dredging, pile driving, and levee breaching; however, machinery used to dredge and breach the levees and undertake pile driving would be operated between July 1 and October 31. This work window is designated by CDFW, DWR, and NMFS as a time when special status fish are least likely to be present. During the in-water work window, an estimated 50,800 cubic yards of soil would be excavated from the breach locations (Table 2.2-3). In addition, impacts due to in-water work would be minimized by timing excavation activities to coincide with low tides to minimize in-water work.

Further, potential for injury or mortality would be reduced by the ability of fish to avoid construction activities. Construction-related noise associated with dredging and excavation (see Impact 3.3-4) would likely cause fish to physically avoid the two breach locations. The northern breach would be located in an area of Miner Slough that is nearly 200 ft wide, which allows for fish passage opposite the breach site. Any inhibitions to movement would be temporary and localized as construction would primarily take place during low tide. The southern breach is located in the Miner Slough spur channel. Construction noise would likely deter fish from entering the spur channel from Miner Slough, and any fish present during construction would likely leave the channel on their own.

Temporary sheet piles may also be installed as part of the the south property levee repair and used in constructing platforms for site dewatering pumps. While sheet piles would most likely be installed out of water using vibratory hammers, an impact pile driver within water may be necessary. Due to the potential for physical injury and mortality to fish from sound attenuation in the water, this would be a potentially significant impact. Sound pressure thresholds set by the Fisheries Hydroacoustic Working Group (2008) could be exceeded by impact pile driving; therefore, implementation of Mitigation Measure 3.3-3.1 would be required to reduce this impact to less than significant.

A possibility for fish injury could occur from a surge of water onto the Project site upon breaching of the levees. However, with high groundwater conditions at the site from seepage and plant management activities, it is anticipated that water surface elevations between the constructed channel network and Miner Slough would equilibrate prior to breaching the levees. Breaching would occur at low tide to minimize any tidal difference and removed from the landward side toward tidal waters in Miner Slough; this would cause the water to gradually fill and not surge into the work areas, thereby minimizing disturbance to fish near the breach site.

Despite the aforementioned, due to the extensive use of the Cache Slough Complex and DWSC by Delta Smelt of all life stages (Sommer and Mejia 2013), there is potential that Delta Smelt juveniles could be present in Miner Slough during July. Larval and juvenile Delta Smelt do not regularly utilize Miner Slough; the CDFW 20-mm Survey, which monitors post-larval and juvenile life stages of fish twice monthly, has not caught Delta Smelt in Miner Slough since April 2010. However unlikely, there is still potential for Delta Smelt to access Miner Slough during construction activities and be injured or otherwise harmed. This would be a significant impact. Implementation of Mitgation Measure 3.3-3.2 would reduce this impact to less than significant.

Overall, due to the implementation of an in-water work window of July 1 to October 31 during low tide (when it corresponds with work hours) and implementation of mitigation measures 3.3-3.1 and 3.3-3.2, direct construction-related activities would not cause adverse individual or population-level effects on special-status and other native fish or their habitat to an extent that would cause a reduction in species abundance or long-term population levels. Therefore, impacts would be less than significant.

Mitigation Measure 3.3-3.1

Pile driving activities shall be conducted using vibratory hammers, where feasible, to minimize sound attenuation from pile driving activities. If in-water pile driving activities become necessary, underwater sound monitoring shall be performed to ensure that peak sound pressure does not exceed 206 decibels and accumulated sound exposure level does not exceed 187 decibels at 10 meters. If work is performed at a time when special-status fish less than 2 grams are expected near the Project Site, accumulated sound exposure levels shall not exceed 183 decibels at 10 meters. Underwater sound reduction measures shall be implemented as needed to ensure that sound levels do not exceed the above thresholds. Sound reduction measures may include impact cushions, pipe caissons, bubble curtains, fabric barriers, and limiting operational hours and impact frequency.

Mitigation Measure 3.3-3.2

DWR shall consult with CDFW and USFWS before conducting any in-water work during the month of July. DWR shall determine the extent of Delta Smelt presence in the Cache Slough Complex and Miner Slough by evaluating catch and distribution data from CDFW's 20-mm Survey[4] and Summer Townet Survey[5]. The results shall be sent to USFWS and CDFW representatives to determine the extent of allowable in-water work.

20-mm Survey stations 724 and 726 are located in Miner Slough at the lower and upper ends of Prospect Island and shall be used to determine Delta Smelt abundance in Miner Slough during July construction activities. Summer Townet Survey Station 715, just downstream of Miner Slough in Cache Slough; Station 723, just upstream from Miner Slough in the DWSC; and Station 716, just upstream from Miner Slough in Lindsey Slough, shall be used to determine Delta Smelt abundance in the vicinity of Miner Slough when the 20-mm Survey is not active.

Impact significance

Less than significant with mitigation

Impact 3.3-4: Short-term construction-related noise impediments to fish migration

The potential for the Proposed Project to impede fish migration was evaluated in terms of:

- the timing and extent of construction activities;
- the timing of fish migrations;
- the dimensions of Miner Slough; and
- the expected levels of noise generated by construction activities.

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[4] The 20-mm Survey is an annual survey conducted by CDFW that monitors postlarval to juvenile Delta Smelt throughout the Delta from March through July. Surveys run every two weeks and include stations in Cache Slough, Lindsey Slough, the DWSC, and Miner Slough.

[5] The Summer Townet Survey is an annual survey that monitors young of the year fish throughout the Delta from June through August. Surveys run every two weeks and include stations in Cache Slough, Lindsey Slough, and the DWSC.

Construction activities at levee breach locations, including excavation and sheet pile installation, could generate sufficient noise within Miner Slough to affect the movement or migration of special-status fish species. Miner Slough is a known migratory corridor for many fish species; all four runs of Chinook Salmon, as well as Steelhead, Green Sturgeon, Pacific and River Lamprey, and Sacramento Splittail may migrate past the Project site in Miner Slough on their way to upstream spawning areas or downstream rearing habitat. While in general, impacts would be minimized through implementation of an in-water work window of July 1 to October 31 when special-status fish are less likely to be present at or near the Project site, migration timing for Fall- and late fall-run Chinook Salmon, Central Valley Steelhead, and Green Sturgeon overlaps with the in-water work window.

With respect to excavation activities, fish are expected to simply avoid construction areas by seeking a zone of passage further away from any noise sources (i.e., along the opposite bank of the slough, which is nearly 200 ft wide at the construction sites). A recent study on barotrauma (i.e., pressure wave) injury and recovery in Chinook Salmon (Casper et al. 2012) showed that sound levels below the current California sound pressure level standards, set by the Fisheries Hydroacoustic Working Group (2008), are not significant enough to cause death or behavior modification in juvenile Chinook Salmon. Salmon exposed to the maximum allowable sound pressure levels showed signs of minor internal injury, but they were not significant enough to discourage normal swimming behavior or feeding activities. Excavation of the levee breaches would initially degrade the levee crown to near MHHW, with final in-water excavation during low and rising tides to minimize turbidity export from the site; therefore, any delays in fish migration would be temporary.

With respect to impact pile driving activities, sound pressure thresholds set by the Fisheries Hydroacoustic Working Group (2008) could be exceeded (see also Impact 3.3-3). Implementation of Mitigation Measure 3.3-3.1 would reduce this impact to less than significant.

Overall, due to the in-water work window of July 1 to October 31 during low tide (when it corresponds with work hours) and implementation of Mitigation Measure 3.3-3.1, construction-related noise would not cause adverse individual or population-level effects on the movements or migrations of migratory fish or their habitat to an extent that could cause a reduction in species abundance or long-term population levels.

Impact significance

Less than significant with mitigation

Impact 3.3-5: Short-term impairment of essential fish behaviors due to potential increases in turbidity during underwater sediment sampling activities

As part of the Proposed Project and prior to any substantial work, sediment sampling would occur in the Miner Slough spur channel to characterize the sediment for beneficial re-use options during dredging operations (Kinnetic 2015). The sampling may occur outside of the proposed in-water work window of July 1 through October 31. If so, there would be potential for adult Winter-run Chinook Salmon, adult and juvenile Spring and Fall-run Chinook Salmon, adult and juvenile Green Sturgeon, juvenile Delta Smelt, and juvenile Longfin Smelt to be in vicinity of the Project site.

Sediment samples would be collected using boat-mounted Vibracore equipment, which utilizes high frequency vibrations to assist core-tube sediment penetration. This method minimizes both in-water pressure waves and sediment re-suspension. In addition, the spur channel is a relatively isolated, dead-end channel with limited connectivity to Miner Slough. Aquatic habitat within the spur channel does not provide desirable spawning or rearing habitat for special-status species. Therefore, potential turbidity releases or other impacts during underwater sediment sampling activities would be less than significant.

Impact significance

Less than significant

Impact 3.3-6: Short-term impairment of essential fish behaviors due to construction-related increases in turbidity

The potential for the Proposed Project to impact fish due to construction-related increases in turbidity was evaluated in terms of:

- construction timing and method of construction activities;
- the extent of disturbance to turbidity and suspended sediment; and
- fish species likely to be present during construction activities.

The Proposed Project has potential to increase turbidity and suspended sediment levels within Miner Slough during repair of the south property levee, dredging of the spur channel, and excavation of levee breaches. Uncontrolled resuspension of sediments during dredging and excavation activities could result in the following direct and indirect adverse effects on fish (Barrett et al. 1992):

- impaired foraging ability of sight-feeding fish;
- impairment to migration up or downstream;
- reduced oxygen uptake and damaged gill filaments; and
- increased predation by piscivorous fish in temporarily turbid areas.

Miner Slough spur channel dredging

The Miner Slough spur channel is a dead-end slough that has limited tidal exchange with Miner Slough. To achieve the intended tidal exchange between Miner Slough and Prospect Island, the spur channel near the southern breach location would be mechanically dredged from its current elevation of -5 to -8 feet NAVD88 to -16 feet NAVD88. This would involve the removal of 47,000 cubic yards of soil from 2,400 linear feet of the dead-end tidal slough. Approximately 5 ac of bottom habitat would be disturbed as a result of mechanical dredging operations (see Impact 3.3-1).

Mechanical (i.e., clam-shell) dredging would occur during the in-water work window of July 1 through October 31 and at low tide (when it corresponds with work hours). While in general impacts would be minimized through implementation of the in-water work window, when special-status fish are less likely to be present at or near the Project site, migration timing for Fall- and late fall-run Chinook Salmon, Central Valley Steelhead, and Green Sturgeon partially overlaps with the in-water work window. Direct injury from clam-shell dredging, while possible, is less of a concern than indirect impacts from sediment release (LaSalle et al. 1991). Thus, clam-shell dredging operations would have the potential to impact these species, as well as other native fish species, by increasing suspended sediment and turbidity.

A localized plume of suspended sediment would be produced by the lowering and raising of the dredge bucket. Palermo et al. (1990) summarized findings of numerous suspended sediment experiments on eggs, larval, juvenile, and adult fish. Larval fish appeared to be the most sensitive life stage to increased suspended sediments; physical damage was apparent at suspended sediment concentrations of over 1,500 mg/L for 24 hours. Depending on conditions, field studies indicate that clam-shell dredging increases suspended sediment concentrations above background measurements by 150-900 mg/L and increases turbidity by 5-150 NTUs (Palermo et al. 1990, USACE 1987) within the general vicinity of the dredge site. Since the Miner Slough spur channel is a dead-end channel with limited tidal exchange, the majority of suspended sediment generated by the dredging activities would settle within the spur channel. Additionally, these values are below those associated with physical damage and/or mortality to sensitive life stages and they are within the range of values produced by high winds, storm events, and strong tides in general (Palermo et al. 1990) and in the Delta (DWR 1996). If suspended sediment levels were to reach temporary values sufficiently high to negatively affect fish, individuals would likely avoid the area in favor of the abundance of quality habitat nearby. Therefore, turbidity is not likely to adversely affect migrating adult and juvenile fish present in Miner Slough (See Section 3.2.1 Water Quality – Setting for more information)..

Overall, despite the low likelihood of significant adverse effects to fish as a result of dredging of the Miner Slough spur channel, the use of turbidity controls (e.g., silt curtains) is included in concept in the Project Description and detailed in Mitigation Measure 3.2-2.1 to further minimize impacts to special-status fish and aquatic resources. Implementation of Mitigation Measure 3.2-2.1 would reduce potential impairments of essential fish behaviors due to construction activities to less than significant.

Miner Slough levee repair and breaching

The south property levee repair would involve installation of a sheet pile with rock slope armoring, which could temporarily increase turbidity within the Miner Slough spur channel. This repair would have a small construction footprint (<0.1 ac).

Breaching of the Miner Slough levee to connect the Project site to tidal action would affect short-term turbidity levels in Miner Slough. The levee breaches would occur in localized areas totaling 1,060 ft at two locations along the west levee of Miner Slough. While in general impacts would be minimized through implementation of an in-water work window of July 1 to October 31, when special-status fish are less likely to be present at or near the Project site, migration timing for Fall- and late fall-run Chinook Salmon, Central Valley Steelhead, and Green Sturgeon partially overlaps with the in-water work window.

The potential for short-term, sediment re-suspension and scouring impacts to these species from levee repair and excavation would be minimized by working during low tide (when it corresponds with work hours) and by working from the landward side toward tidal waters in Miner Slough to breach the levee. For necessary in-water work, excavation of the levee breaches would occur over a maximum period of a few hours to one day at each location. Excavated soils would be moved by bulldozers away from the excavation area or placed into dump trucks to be transported offsite. Therefore, any increases in turbidity in Miner Slough as a result of levee breach excavation would be temporary and localized.

Overall, due to the implementation of an in-water work window of July 1 to October 31 and Mitigation Measure 3.2-2.1, the south property levee repair and subsequent breaching would not cause adverse individual or population-level effects on the movement, migration, or behavior of special-status fish to an extent that could cause a reduction in species abundance or long-term population levels. Therefore, impacts would be less than significant.

Impact significance

Less than significant with mitigation

Impact 3.3-7: Short-term fish injury or mortality during dewatering

The potential for fish to be killed or injured as a result of dewatering was evaluated in terms of the rate of dewatering, and the presence and species composition of fish on Prospect Island.

Dewatering of Prospect Island would remove aquatic habitat from the site, which would eventually result in mortality of all fish on the island. As part of the dewatering process, fish could be stranded in isolated pools of water that remain as the surrounding water level is drawn down or they could be entrained in the dewatering pumps. Although there are no special-status fish present on the island (Table 3.3-2), there are native and important sport fish species that are important to the ecology of the Delta.

Prospect Island has a gradual slope from intertidal and upland habitat in the northern portion to subtidal and deep subtidal near the cross levee and the existing pump location. Due to the length of time required for initial dewatering (10–12 months), fish would have ample opportunity to escape shallow habitat in the northern portion and avoid becoming trapped in isolated bodies of water. Moyle et al. (2007) showed that native fish on a floodplain are highly successful at escaping the floodplain as water recedes, while non-native fish have higher rates of stranding.

Eventually, fish would congregate in the deep subtidal areas at the southern end of the island, near the pumps, where injury or mortality would occur due to continued loss of water or entrainment in the pumps. This would be a significant effect. Development and implementation of fish rescue operations (Mitigation Measure 3.3-7.1) would minimize the direct loss of fish and would result in a less than significant impact.

Mitigation Measure 3.3-7.1
To minimize mortality due to the dewatering process, a fish rescue plan shall be prepared by DWR for approval by state and federal fish agencies (CDFW, USFWS, NMFS). Development of the fish rescue plan shall include consideration of numerous sampling methods (seines, electrofishing, traps) and events, performed during and potentially after initial site dewatering. Fish would be captured alive and transported to nearby suitable habitat for release. The fish rescue would occur under the direction of CDFW.

Impact significance
Less than significant with mitigation

Impact 3.3-8: Fish injury or mortality due to herbicide application

The potential for the Proposed Project to result in adverse impacts to non-target organisms from the application of herbicide to control invasive plants was evaluated in terms of:

- the proximity or presence of aquatic biological resources during herbicide application;
- the effects and toxicity of particular herbicides on those resources; and
- the likelihood of chemicals coming into contact with aquatic biological resources.

Herbicides can have a negative effect, both directly and indirectly, on the aquatic biological resources of affected water bodies. These chemical compounds can enter water bodies through a number of different pathways, such as direct application to surface water, surface runoff, spray drift, soil leaching, plant uptake, and volatization (Zhang and Goodhue 2010). Exposure of fish and other aquatic biological resources to herbicides can cause mortality as well as other long term effects on reproductive success, growth, and survival (Pimentel 2005).

Aquatic-approved formulations containing the active ingredients glyphosate and imazapyr would be the two most utilized herbicides for large scale application under the Proposed Project (Table 3.2-11). Toxicity potential for these herbicides, as well as for aminopyralid and surfactants, is evaluated in Impact

3.2-3, including consideration of herbicide type (i.e., aquatic-approved), application method (i.e., to dewatered soils following fish rescue operations), application frequency (i.e., once immediately following dewatering), amount applied (i.e., according to label specifications), and toxicity (i.e., slightly toxic to practically nontoxic). The analysis suggests that there is a low likelihood of toxicity due to aquatic herbicide application within Prospect Island. This is particularly true for glyphosate, which exhibits low soil mobility and is not likely to be present in runoff and/or pumped discharge following application.

An additional consideration with respect to potential impacts to aquatic species is that of toxicity risk, which takes into account both toxicity and exposure using the hazard quotient calculation. If the ratio of the predicted exposure value and the toxicity reference value (called the Hazard Quotient) is less than 1, then no adverse effects as a result of exposure are expected (SERA 2011a, b). Neither glyphosate nor imazapyr exceed the level of concern (LOC) for special-status fish species under acute and chronic exposure scenarios reported for a reference study (Table 3.3-11, Table 3.3-12), where exposure estimates are obtained from a single event herbicide runoff model (USEPA 2008). It should be noted that the reference study used formulations of glyphosate and imazapyr that are not wetland approved, so any formulation used under the Proposed Project would result in even lower hazard quotients than the reference study. Overall then, there would be a low toxicity risk to aquatic biological resources from the application of herbicides for invasive plant control at the Project site.

Table 3.3-11. Acute and Chronic Exposure Scenarios for Glyphosate for Special-status Fish in a Reference Study Using an Application Rate of 3.75 Pounds Acid-Equivalent/Acre (SERA 2011a)

Fish Species	Exposure Scenario[1]	Exposure Estimate (mg/L)	Toxicity Value (mg/L)[2]	Hazard Quotient	Exceed Level of Concern?
Green Sturgeon	Acute	0.04125	0.048	0.9	No
	Chronic	0.00071	0.048	0.015	No
Delta Smelt	Acute	0.04125	0.048	0.9	No
	Chronic	0.00071	0.048	0.015	No
Chinook Salmon, spring-run	Acute	0.04125	0.048	0.9	No
	Chronic	0.00071	0.048	0.015	No
Chinook Salmon, winter-run	Acute	0.04125	0.048	0.9	No
	Chronic	0.00071	0.048	0.015	No
Steelhead	Acute	0.04125	0.048	0.9	No
	Chronic	0.00071	0.048	0.015	No

1 Acute exposure bioassays = 96 hours. Chronic exposure bioassays = 28 days.
2 Acute toxicity value is typically the median lethal concentration (LC 50) that is the concentration in water which kills 50% of a test batch of fish within a continuous period of exposure (96 hours). Chronic toxicity value is expressed as the concentration in water which below an unacceptable effect is unlikely to be observed.

Table 3.3-12. Acute and Chronic Exposure Scenarios for Imazapyr for Special-status Fish in a Reference Study Using an Application Rate of 1.5 Pounds Acid Equivalent/Acre (SERA 2011b)

Fish Species	Exposure Scenario	Exposure Estimate (mg/L)	Toxicity Value (mg/L)	Hazard Quotient	Exceed Level of Concern?
Green Sturgeon	Acute	0.015	10.4	0.001	No
	Chronic	0.005	4	0.001	No
Delta Smelt	Acute	0.015	10.4	0.001	No
	Chronic	0.005	4	0.001	No
Chinook Salmon, spring-run	Acute	0.015	10.4	0.001	No
	Chronic	0.005	4	0.001	No
Chinook Salmon, winter-run	Acute	0.015	10.4	0.001	No
	Chronic	0.005	4	0.001	No
Steelhead	Acute	0.015	10.4	0.001	No
	Chronic	0.005	4	0.001	No

1 Acute exposure bioassays = 96 hours. Chronic exposure bioassays = 28 days.
2 Acute toxicity value is typically the median lethal concentration (LC 50) that is the concentration in water which kills 50% of a test batch of fish within a continuous period of exposure (96 hours). Chronic toxicity value is expressed as the concentration in water which below an unacceptable effect is unlikely to be observed.

In addition to the low toxicity risk, implementation of Mitigation Measures 3.2-3.1 and 3.2-3.2 would reduce the potential for off-target spray drift from aerial application and the possibility of accidental spills. Overall, there would be no impact to fish due to the application of herbicide to control invasive plants.

Impact significance
No impact

Impact 3.3-9: Post-construction increased predation on native fish

The potential for the Proposed Project to result in increased predation on native fishes, including special-status fish species, was evaluated in terms of:

- the foraging behavior and habitat preferences of piscivorous fish;
- design features of the Proposed Project intended to minimize the potential for such habitat conditions to occur; and
- the species, life history timing, and avoidance behaviors of fish that would likely be preyed upon.

Restoration of tidal wetlands and their constructed channel network on Prospect Island would have the beneficial effect of increasing the amount of habitat available to aquatic organisms. However, the new habitat could also be used year-round by a wide variety of piscivorous fish, such as Striped Bass (*Morone saxatilis*), Largemouth Bass (*Micropterus salmoides*), and other non-native fishes in the families Centrarchidae (black basses, crappie, and sunfish) and Ictaluridae (catfish and bullheads). The expanded habitat also may provide the potential for increases in the number of piscivorous wildlife species, such as egrets, herons, raccoons, and otters, which may use the site for foraging.

The presence of piscivorous fish and wildlife throughout the restored wetlands and constructed channel network, but especially in the areas of the levee breaches, would create the potential for the restored tidal wetland habitat to become a biological “sink”. Small fish, including Delta Smelt and juvenile anadromous salmonids, would enter the levee breach areas on tidal inflows and could be preyed upon by piscivorous fish and wildlife. This is because, when high velocity water passes through the breach on flood and ebb tides, it meets low velocity water on the other side and creates turbulent eddies. Predatory fish are known to take advantage of these eddies by congregating near breach locations and preying on disoriented fish (Vogel 2011).

However, the Proposed Project includes “built in” aquatic habitat features designed to favor native fish species, while discouraging the establishment and colonization by non-native, piscivorous fish. A breach velocity dissipater is included in the design of the northern breach location (Figure 2.2-8). The dissipater would help prevent predation by piscivorous fish by reducing the turbulent effects of incoming water. An adaptive management study would be incorporated into monitoring to test the effectiveness of the energy dissipater at reducing predation compared with existing rates in the surrounding waterways and nearby flooded islands and tidal wetlands.

The constructed channel network geometry represents another design feature that favors native fish species. The constructed channels would be excavated to depths that minimize the potential for colonization by aquatic vegetation, which can provide habitat for piscivorous fish; standing dead trees would also be removed to discourage piscivorous fish. Constructed channels would be sized to promote peak tidal flow velocities of about three feet per second, which is expected to largely preclude invasive Brazilian waterweed (*Egeria densa*) from becoming established onsite. Brazilian waterweed is known to invade natural waterways and substantially impede water flow, reduce turbidity, harbor invasive predator fish species, and decrease the quality of habitat for native resident and anadromous fish (Li and Yang 2009, Grimaldo and Hymanson 1999).

The growth benefits of restored wetland habitat have been demonstrated to benefit juvenile Chinook Salmon and Sacramento Splittail (Junk et al. 1989, Moyle et al. 2007, Nobriga and Feyrer 2007, Sommer et al. 2001a, 2001b). The increase in wetland habitat and high food productivity provided by the Proposed Project (WWR and SWS 2014) would result in robust growth rates and larger body sizes of these fish, thereby further increasing their chances to survive predation. Larger fish are stronger swimmers (Videler and Wardle 1991) and can more actively avoid predation. Body size is also important to surpassing the mouth gape of predators (Lundvall et al. 1999), effectively eliminating the potential for predation by piscivorous fish.

Overall, the presence of levee breaches would not cause adverse individual or population-level effects on the survival of special-status fish to the extent that they would cause a reduction in species abundance or long-term population levels. Given the multiple design features inherent to the Proposed Project that favor native fish species, predation levels would be similar to, and potentially lower than, existing rates in the surrounding waterways and nearby flooded islands and tidal wetlands. Therefore, impacts would be less than significant.

Impact significance

Less than significant

Impact 3.3-10: Long-term impacts to fish in Prospect Island and adjacent water bodies from changes in water temperature

The potential for the completed Proposed Project to have long-term adverse water temperature impacts to fish and aquatic resources was evaluated in terms of:

- current temperatures within and adjacent to Prospect Island,
- the extent and magnitude of the expected changes, and
- the specific detrimental effects the temperature change would have on aquatic resources.

Shallow water habitats are potentially subject to increased water temperature as a result of direct solar radiation and influence from ambient air temperatures. Increased temperatures can sub-lethally affect aquatic organisms through reduced growth and/or maturation rates, increased vulnerability to predation, increased risk of disease, and in the case of extreme temperatures, can cause mortality (Myrick and Cech Jr. 2001). Of the fish and invertebrate communities potentially occurring on the restored tidal wetland, anadromous salmonids have the lowest temperature tolerances (Myrick and Cech Jr. 2001) and have the potential to occur within the restored wetlands for extended time periods. Therefore, if temperatures on the Project site and in adjacent water bodies are suitable for Chinook Salmon and Steelhead, they would likewise be suitable for warm water resident fish species, as well as other anadromous or migratory fish (e.g., Green Sturgeon, Delta Smelt, Longfin Smelt).

Juvenile Chinook Salmon show positive growth at temperatures ranging from 46°F (8°C) to 77°F (25°C) (Clarke and Shelbourn 1985, Brett et al. 1982). At 77°F (25°C), there is an imminent risk of mortality of salmon and trout species in natural rivers and streams (Myrick and Cech Jr. 2001). Brett et al. (1982) reared juvenile Chinook Salmon at temperatures ranging from 60°F to 77°F (16°C to 25°C) to monitor growth rates and mortalities and showed temperature related mortalities occurred only in those fish reared at 77°F (25°C). The first death occurred on day 8, with half of the stock dead on day 28. Growth rates were optimal at 69°F (21°C); lower temperatures resulted in slight decreases in growth rates, while higher temperatures resulted in larger declines in growth rates. From these results, suitable (less than 69°F [20°C]), sub-optimal (between 69°F and

77°F [20°C and 25°C]), and lethal (above 77°F [25°C]) temperature categories were applied for interpretation of modeling results on temperature changes due to implementation of the Proposed Project.

Temperatures were examined for Prospect Island and Miner Slough using a sensor located in the southeast corner of the north property and on the Highway 84 Bridge in Miner Slough. These temperatures were then compared to Phase 2 modeling results following restoration to tidal marsh (Table 3.3-13). Results indicate that under existing conditions, temperatures in Prospect Island and Miner Slough are generally suitable (less than 68°F [20°C]), but Miner Slough also experiences sub-optimal (between 68°F and 77°F [20°C and 25°C]) temperatures during warmer months. From January through May, temperatures are almost always in the suitable range for juvenile salmonids, varying from 47.3°F to 70.8°F (8.5°C to 21.6°C), with the highest temperatures occurring for just a few hours a day. June reflects the transition from the cooler temperatures of winter/spring to the warmer temperatures of summer/fall. July and August are dominated by sub-optimal conditions, followed by cooling in September, which is still generally dominated by sub-optimal conditions, but is transitioning to more suitable temperatures. Observed temperatures did not approach or exceed lethal temperatures (greater than 25°C) at any time during the analysis period.

Table 3.3-13. Monthly Measured Daytime Average (2011-2013) and Post-construction Modeled (2010) Water Temperatures for Miner Slough and Prospect Island

Month	Average Temperature ºF (ºC)			
	Miner Slough Measured	Prospect Island Measured	Miner Slough Modeled	Prospect Island Modeled
Jan	47.3 (8.5)	46 (7.8)	--	--
Feb	50.2 (10.1)	49.6 (9.8)	--	--
Mar	53.2 (11.8)	53.4 (11.9)	55.6 (13.1)	54.1 (12.3)
Apr	59.5 (15.3)	59.2 (15.1)	58.1 (14.5)	57 (13.9)
May	64.4 (18)	63.7 (17.6)	61.3 (16.3)	61.2 (16.2)
Jun	68 (20)	66.2 (19)	66.4 (19.1)	68.2 (20.1)
Jul	70.5 (21.4)	67.5 (19.7)	70.5 (21.4)	70.3 (21.3)
Aug	70.9 (21.6)	67.6 (19.8)	69.8 (21)	69.3 (20.7)
Sep	68.5 (20.3)	66.4 (19.1)	68 (20)	68.5 (20.3)
Oct	62.6 (17)	61.5 (16.4)	--	--
Nov	55.4 (13)	54.3 (12.4)	--	--
Dec	48.4 (9.1)	47.1 (8.4)	--	--

Measured data are from California Data Exchange Center online database: http://cdec.water.ca.gov/. The Miner Slough station (HWB) is located in Miner Slough at the Highway 84 Bridge, and the Prospect Island Station (B91400 PI-1) is located at the southeast corner of Prospect Island near the pumps (*http://www.water.ca.gov/waterdatalibrary/docs/Hydstra/index.cfm?site=B91400*). Modeled data is from Appendix B in WWR and SWS (2014).

Post-restoration water temperature modeling was performed for Prospect Island and the surrounding waterways when smelt and salmon were most likely present and when temperatures were the most extreme (March through September) (Appendix B in WWR and SWS 2014). In general, temperatures within the restored Prospect Island would reflect the pre-restoration temperature trends. This indicates that fish would encounter a temperature regime that is conducive to growth during all emigration and rearing periods throughout the year. In addition, the temperatures within the restored island tended to be in the suitable range for longer periods of time than in the surrounding water bodies. Within Prospect Island in July and August, temperature conditions were also within sub-optimal ranges, but included many days in the suitable category, indicating a general cooling effect by the Proposed Project.

In the unlikely scenario in which temperatures in the restored tidal wetland reach critical levels, fish would likely exit Prospect Island in search of cooler water as temperatures began to exceed their thermal preferences. The tidal wetland habitat created by the Proposed Project would not likely increase water temperatures within the constructed channel network or in Miner Slough to levels that would have adverse effects on anadromous salmonids or other resident or migratory fish.

With respect to potential temperature changes in the surrounding waterways, results were modeled for a number of locations throughout the Cache Slough Complex (Appendix B in WWR and SWS 2014). There was no change in the number of suitable days for Miner Slough at the Highway 84 Bridge and Lindsey Slough. Cache Slough at Miner Slough, the Deep Water Ship Channel, and Cache Slough at Ryer Island all showed two fewer suitable days. South Miner Slough resulted in three additional suitable days in July and two fewer suitable days in September. These increases or decreases in temperatures resulting in changes to the number of suitable days are negligible. The magnitudes of deviations from the 2012 temperatures were small, and the effect was localized and temporary. Unfavorable conditions encountered by fish would be avoided in favor of the abundance of suitable habitat nearby.

Modeled temperature changes within Prospect Island, Miner Slough, and the Cache Slough Complex do not indicate a likelihood of adverse individual or population-level effects on the survival of special-status fish, or their associated habitats, to an extent that could cause a reduction in species abundance or long-term population levels. Conversely, model results indicate the potential for slight improvements in seasonal water temperatures within Prospect Island under the Proposed Project. Water temperatures would likely be similar to current temperatures in surrounding streams and sloughs. Overall, there would be a beneficial effect on long-term water temperatures.

Impact significance

Beneficial

Impact 3.3-11: Altered habitat and food web from invasion by Asian clam

The potential for the Proposed Project to increase Asian clam (*Corbicula fluminea*) habitat and impact the aquatic food web was evaluated in terms of the likelihood of expanding the current clam population, the extent of its possible habitat, and the impacts it would have on fish and freshwater tidal marsh habitat. Asian clams are known to drastically alter natural habitats by increasing water clarity, changing benthic communities, and depressing phytoplankton production (Sousa et al. 2008, Kramer-Wilt 2010, Lopez et al. 2006). This habitat alteration may result in reduced growth rates of special-status fish and increased predation rates by piscivorous fish.

Preliminary sampling by CDFW (unpubl. data, March 2014) indicated no evidence that Asian clams are currently established on Prospect Island. However, the completed restoration would increase connectivity and, accordingly, colonization opportunities for clam larvae. Of the other exotic invasive species (i.e., nonnative fish and aquatic plants) that can or already have established a population on Prospect Island, the Asian clam is the only species whose establishment is not likely to be prevented through design criteria like flow velocity or water surface elevation (Sousa et al. 2008). Further, design criteria (water temperature, dissolved oxygen) meant to benefit native fish would also benefit Asian clam survival due to similar physiological survival requirements (Mattice and Dye 1975, Hanson 1997).

Asian clam growth, density, and survival depend on numerous factors, including substrate, water quality, and flow, but how these factors contribute to the current structure of Asian clam populations in the Delta is not well understood (Brown et al. 2007). Given its suite of reproductive specializations (Lucas and Thompson 2012), its current establishment in Cache Slough (Section 3.3.1 Aquatic Biological Resources – Setting), and the projected level of primary productivity at the restored site (see Impact 3.2-7), there would be an increased likelihood of Asian clam colonization under the Proposed Project. However, Kramer-Wilt (2010) summarized various studies on Asian clam, with contradicting results regarding habitat types within which Asian clams successfully establish. Therefore, the extent to which this species would colonize within the restored Project site is speculative.

Currently, most of Prospect Island is isolated and does not export productivity to surrounding waterways. Following restoration, the Proposed Project would likely produce zooplankton similar to that of surrounding waterways (Table 3.3-8) and could be a source of food for Delta Smelt or other special-status fish. Even in the presence of Asian clam, there would be a net export of primary and secondary productivity to surrounding streams and sloughs compared with existing conditions. Thus, invasion of the restored Prospect Island by Asian clam would not cause adverse individual or population-level effects on the survival of special-status fish, or their associated habitats, to an extent that could cause a reduction in species abundance or long-term population levels. Overall, impacts would be less than significant.

Impact significance
Less than significant

Impact 3.3-12: Food web impacts from increased levels of methylmercury bioaccumulation

The potential for the Proposed Project to have methylmercury bioaccumulation impacts on the food web was evaluated in terms of the likelihood that the Project would increase methylmercury levels.

As discussed in Section 3.2 Water Quality, mercury methylation is a concern for wetland restoration projects in the Bay-Delta because certain types of wetland habitats are known to support the biogeochemical processes that transform the relatively inert forms mercury into the bioavailable form of methylmercury. While total mercury would not change as a result of the Proposed Project, there could be an increase in methylmercury production within Prospect Island and transport to waters surrounding Prospect Island. A localized increase in water column methylmercury could result in increased levels of mercury bioaccumulation in aquatic organisms regularly inhabiting the area, especially top predators like Largemouth Bass and Striped Bass.

Certain aquatic habitats are more likely to serve as sources of methylmercury than others. Mudflats and irregularly inundated areas such as high marsh zones and flooded bypasses seem to have the highest rates of methylmercury export while emergent tidal marshes and open water habitats appear to have the lowest rates of production, and can even serve as methylmercury sinks (Slotton et al. 2002). Since the Proposed Project would result in tidal open water (472 ac, 31%) and tidal wetland (1,053 ac, 69%) with only fringes of high marsh, it is anticipated that there would be relatively little, if any, increases in methylmercury production and bioaccumulation associated with the Proposed Project (see also Section 3.2.3 Water Quality – Impacts and mitigation).

In addition, DWR would be participating in methylmercury control studies (Section 3.2.3 Water Quality – Impact 3.2-7) aimed at monitoring methylmercury export from tidal wetlands, potentially including Prospect Island. This monitoring would allow for assessment of conditions following restoration.

Overall, the Proposed Project is not likely to significantly increase levels of methylmercury production and bioaccumulation in or near the Project site. Therefore, with respect to potential food web impacts due to increased levels of methylmercury bioaccumulation, the Proposed Project would not cause adverse individual or population-level effects on the survival of special-status fish, to an extent that could cause a reduction in species abundance or long-term population levels. Impacts would be less than significant.

Impact significance

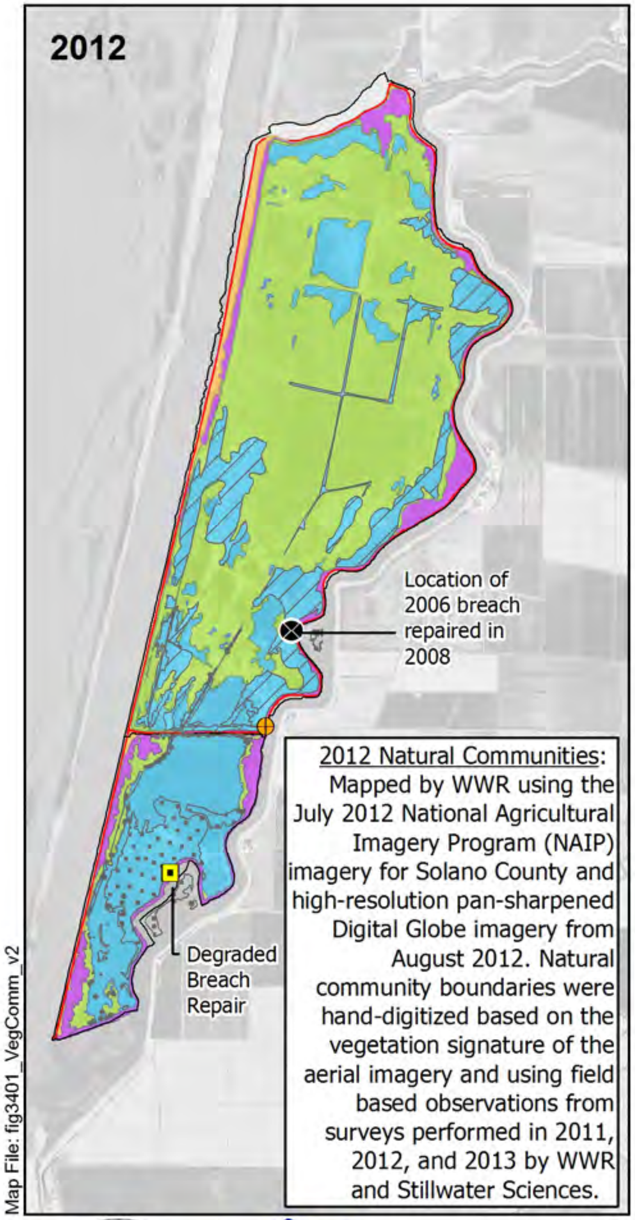
Less than significant

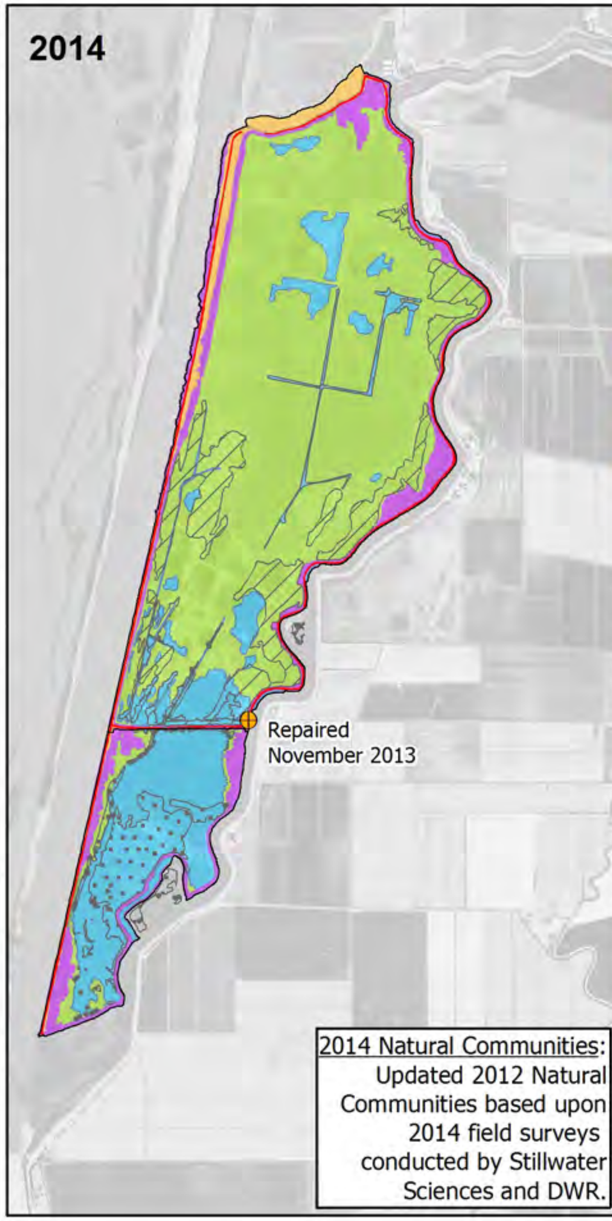
3.4 Wetland and Terrestrial Biological Resources

This section describes wetland and terrestrial habitats in the Proposed Project site and assesses potential impacts to habitats and special-status species resulting from the Project. The assessment is based on a combination of literature review, database inquiries, mapping, site reconnaissance, USACE verified wetland delineation, and species surveys. Wetland and terrestrial biological resource issues include potential effects on wetland, open-water, riparian, and terrestrial habitats and species.

3.4.1 Setting

Prospect Island is surrounded by levees and is divided into the north property and the south property by an interior cross levee (Figure 2.1-1). The interior of the island is flooded. Generally, elevations within Prospect Island range from -3 ft to more than 8 ft (NAVD88) on the north property and from 0.1 ft to more than 8 ft (NAVD88) on the south property (DWR and CDFW 2014). The north property primarily consists of freshwater wetlands with riparian and terrestrial habitats associated with the surrounding levees. The south property is predominantly open-water aquatic habitat with muted tidal influence through gaps in the large rocks of a degraded levee breach repair along Miner Slough. Waterways surrounding Prospect Island are comprised of perennial aquatic (open water) habitat bordered by valley/foothill riparian, with limited amounts of tidal freshwater emergent wetland habitat within the Miner Slough Wildlife Area as well as along the degraded levee bordering Liberty Island. Agricultural lands are located to the north and east of Prospect Island. Natural communities present at the Project site are described below based on information provided in the Restoration Plan (DWR and CDFW 2014) and are shown in Figure 3.4-1. Existing acreages of each natural community are also provided in Table 2.2-2.





Natural Communities
BDCP Nomenclature *(DWR Nomenclature)*

- Road/Developed
- Non-Tidal Perennial Aquatic *(Open Water)*
- Non-Tidal Freshwater Perennial Emergent Wetland *(Non-Tidal Marsh)*
- Valley Foothill Riparian *(Riparian Forest)*
- Grassland *(Ruderal Grassland)*
- Flapgate
- Prospect Island
- *Ludwigia* spp.
- *Ludwigia* spp. mixed with *Polygonum amphibium*

Natural Communities	**2012**	**2014**	**Change**
	Acres		
Non-Tidal Perennial Aquatic	573	350	-223
Non-Tidal Freshwater Perennial Emergent Wetland	872	1101	+228
Valley Foothill Riparian	123	145	+22
Grassland	38	84	+46
Road/Developed	15	4	-11
Not Mapped	63	0	-33
Totals	1684	1684	0

Note: Following the repair of the flap gate in November 2013, emergent wetland extent in 2014 has increased relative to conditions mapped in 2012.

Data Sources: Imagery (NAIP 2012), Natural Communities (WWR and SWS 2013, 2014); Ludwigia (Anderson 2012 and SWS 2013)

Map File: fig3401_VegComm_v2

1:48,149 (1 in = 0.8 mile at letter size)
0 0.4 0.8 Mi
0 0.6 1.2 Km

Figure 3.4-1

Vegetation Communities 2012 and 2014 at Prospect Island

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Environmental setting

Natural communities

The Prospect Island vegetation communities described below follow the BDCP natural communities classification system (Chapter 2 in DWR 2013b).

Non-tidal perennial aquatic

Non-tidal perennial aquatic communities are areas of mostly open water. Vegetation in this community includes native aquatic plants such as water smartweed (*Persicaria amphibia*), duckweed (*Lemna minor*), and mosquito fern (*Azolla filiculoides*), and non-native plants such as water primrose (*Ludwigia* sp.), parrotfeather (*Myriophyllum aquaticum*), and curlyleaf pondweed (*Potamogeton crispus*). The non-tidal perennial aquatic community is found in lower-elevation areas on the north and south property and in remnant agricultural ditches.

Non-tidal perennial aquatic habitat has the potential to support primary and secondary productivity of plankton and aquatic invertebrates to the aquatic food web, foraging habitat at the margins for reptiles (e.g., giant garter snake, western pond turtle) as well as broad areas of habitat for waterfowl and non-native fish species (Section 3.3.1 Aquatic Biological Resources – Setting). Under existing conditions, the levees that surround the property limit hydraulic exchange as well as aquatic species access to non-tidal habitat within the Project site, including access by native fishes of special concern.

Tidal perennial aquatic

Tidal perennial aquatic habitat surrounding Prospect Island consists primarily of open-water habitat subject to tidal influence. Vegetation is sparse, consisting of floating plants such as water hyacinth (*Eichhornia crassipes*) or submerged plants like Brazilian waterweed (*Egeria densa*).

Tidal perennial aquatic communities have the potential to support primary and secondary productivity and transport; potential foraging habitat at the margins for reptiles (e.g., giant garter snake, western pond turtle); and rearing, foraging, and spawning habitat for native fishes of special concern (Section 3.3.1 Aquatic Biological Resources – Setting).

Non-tidal freshwater perennial emergent wetland

Non-tidal freshwater perennial emergent wetlands occur in areas of Prospect Island that are permanently saturated or perennially inundated. This community is dominated by cattails (*Typha latifolia*), common tule (*Schoenoplectus acutus*), and water smartweed. Common reed (*Phragmites australis*), common rush

(*Juncus effusus*), water primrose (*Ludwigia* sp.), and southern bulrush (*Schoenoplectus californicus*) are also interspersed in this community.

Non-tidal freshwater perennial emergent wetlands provide cooler water temperatures to adjacent water bodies through shading and evapotranspiration and also support biogeochemical transformation and sequestration of dissolved nutrients in emergent vegetation and soils (Section 3.2.3 Water Quality – Impacts and mitigation). They also have the potential to support primary and secondary productivity of plankton and aquatic invertebrates; nesting, foraging, and roosting habitat for birds (e.g., Northern Harrier, White-tailed Kite, Short-eared Owl, Song Sparrow, Yellow-headed Blackbird); and foraging habitat and cover for reptiles (e.g., giant garter snake, western pond turtle). Under existing conditions, the levees that surround the property limit hydraulic exchange.

Tidal freshwater emergent wetland

A narrow band of wetland vegetation is present along the water side of the west bank of the Miner Slough levee where tidal influence inundates or saturates the soil. This community is dominated by rush and tule, with other species represented within the understory of the valley/foothill riparian community in some locations.

Tidal freshwater emergent wetlands provide cooler water temperatures to adjacent water bodies through shading and evapotranspiration and also support biogeochemical transformation and sequestration of dissolved nutrients in emergent vegetation and soils (Section 3.2.3 Water Quality – Impacts and mitigation). They also have the potential to provide primary productivity (e.g., algae, plant litter) and secondary productivity of aquatic invertebrates that support the aquatic food web. In addition, this community type provides potential foraging habitat and cover for reptiles (e.g., giant garter snake, western pond turtle); nesting, roosting, and foraging habitat for birds (e.g., Northern Harrier, White-tailed Kite, Short-eared Owl, Song Sparrow, Yellow-headed Blackbird, California Black Rail); foraging habitat for mammals (e.g., western red bat); and rearing, foraging, and spawning habitat for native fishes of special concern (Section 3.1.1 Hydrology – Setting).

Valley/Foothill riparian

The valley/foothill riparian community is a transition zone between aquatic and terrestrial habitats. This community occurs along the higher elevation margins of aquatic and wetland habitats and on upland portions of the levees. Representative tree species include Gooding's willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), cottonwood (*Populus fremontii*), Oregon ash (*Fraxinus latifolia*), and boxelder (*Acer negundo*). Shrub species making up valley/foothill riparian communities or present as understory plants in riparian woodlands include: sandbar willow (*Salix exigua*), Himalayan blackberry (*Rubus armeniacus*), California blackberry (*Rubus ursinus*), California rose (*Rosa californica*), red-osier dogwood (*Cornus sericea*) and blue elderberry (*Sambucus nigra* ssp. *caerulea*). Numerous snags of relict riparian trees protrude above the water surface in inundated areas of the island that formerly supported riparian woodland.

Valley/foothill riparian communities generally provide habitat for invertebrates (e.g., valley elderberry beetle); basking, overwintering, and nesting habitat for reptiles (e.g., western pond turtle, giant garter snake); nesting, foraging, and roosting habitat for birds (e.g., Northern Harrier, Swainson's Hawk, White-tailed Kite, Yellow Warbler, Yellow-breasted Chat, Song Sparrow, Least Bell's Vireo); roosting and foraging habitat for mammals (e.g., western red bat); and shaded cover and source of terrestrial insects for fish (Section 3.3.1 Aquatic Biological Resources – Setting).

Upland communities

Upland communities at the Project site consist of grasslands and former agricultural/cultivated lands. Grassland is composed of non-native or native annual and perennial grasses and forbs (non-grass herbaceous species). Non-native species include ripgut brome (*Bromus diandrus*), wild oats (*Avena fatua*), rye grass (*Festuca perenne*), Bermuda grass (*Cynodon dactylon*), poison hemlock (*Conium maculatum*), fennel (*Foeniculum vulgare*), wild radish (*Raphanus sativus*), milk thistle (*Silybum marianum*), perennial pepperweed (*Lepidium latifolium*) and white sweetclover (*Melilotus albus*). Native species include western goldenrod (*Euthamia occidentalis*) and mugwort (*Artemisia douglasiana*).

Upland communities generally provide foraging habitat for birds (e.g., White-tailed Kite, Northern Harrier, Swainson's Hawk); basking, overwintering, and nesting habitat for reptiles (e.g., giant garter snake); and foraging habitat for mammals (e.g., western red bat).

Jurisdictional Waters of the United States, including wetlands

Waters of the U.S., including wetlands, are shown in Table 3.4-1 and Figure 3.4-2 for the Project site. Additional details on jurisdictional features within the Project site are provided in the *Wetland Delineation* (DWR 2014a).

Table 3.4-1. USACE Jurisdictional Waters and Wetlands in the Project Site

Type of Jurisdictional Feature	Total (Acres)
WATERS OF THE U.S.[a]	
Tidal Waters of the U.S.	219
Non-tidal Waters of the U.S.	131
Total Waters of the U.S., excluding wetlands	**350**
WETLANDS[a]	
Non-tidal freshwater perennial emergent wetland	1,065
Tidal freshwater emergent wetland	35
Valley/foothill riparian wetland	81
Total jurisdictional wetlands	**1,181**
TOTAL USACE JURISDICTIONAL WATERS OF THE U.S., INCLUDING WETLANDS	**1,531**
NON-JURISDICTIONAL UPLANDS	
Uplands	153
TOTAL PROJECT SITE	**1,684**

a Subject to Section 404 of the CWA.

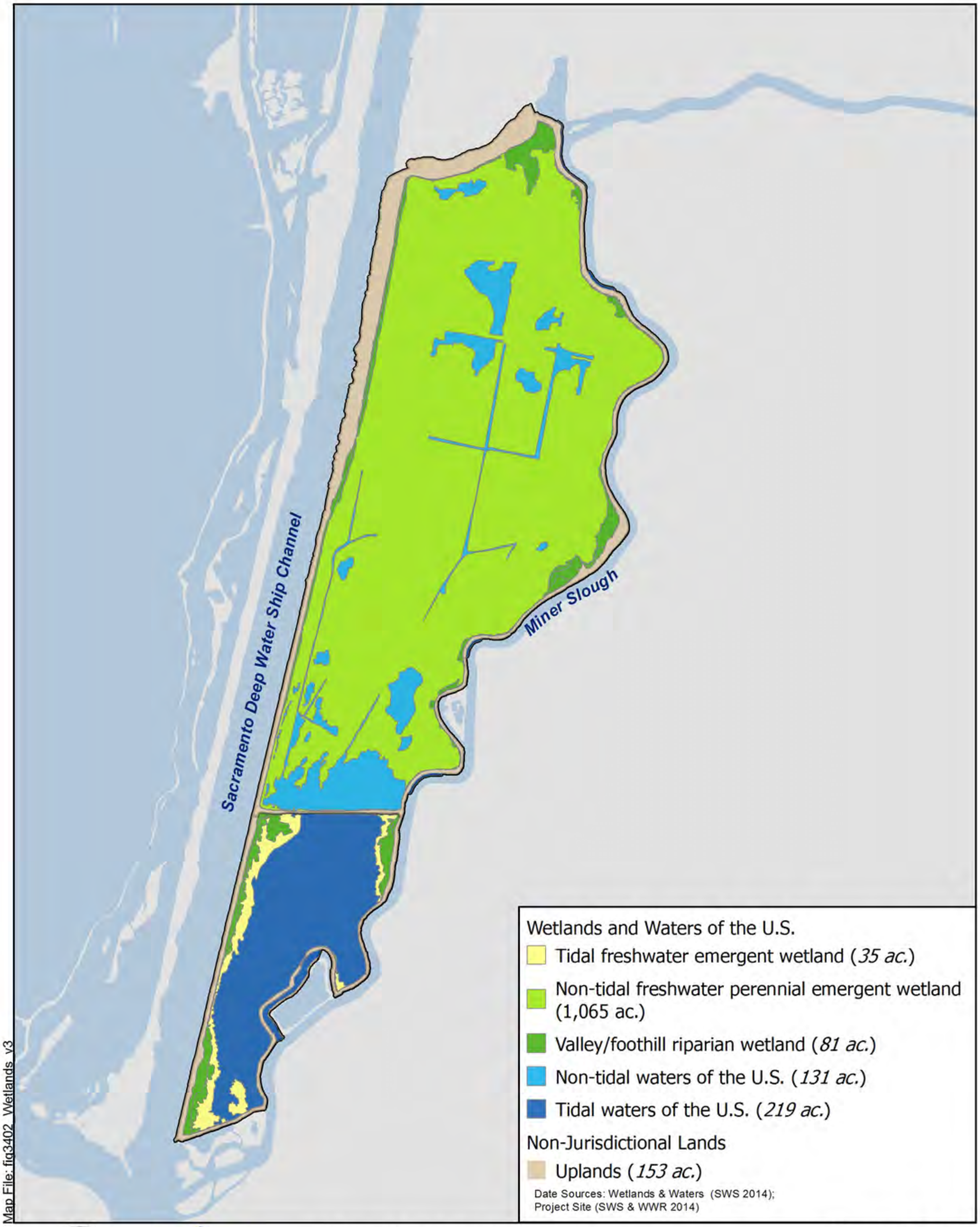


Figure 3.4-2
Waters and Wetlands of the U.S. at Prospect Island

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Tidal Waters of the U.S.

Tidal waters of the U.S. (i.e., traditional navigable waters subject to tidal influence) subject to Section 10 of the Rivers and Harbors Act occur at elevations below the MHW line within Miner Slough, the DWSC, as well as within the south property. The Project site is connected to Miner Slough through a degraded breach repair located south of the cross levee that currently allows limited tidal exchange. Because this connection provides only limited tidal exchange and does not allow fish passage or fully support associated tidal habitat functions, non-tidal natural community types were assigned to aquatic habitats below MHHW within the interior portions of the south property (Table 2.2-2).

Non-tidal Waters of the U.S.

All of the waters of the U.S. within the Project site are non-navigable, with both tidal and non-tidal waters subject to jurisdiction under Section 404 of the CWA. Hydrologic connections between the Project site waters and Miner Slough occur north of the cross levee at a flap gate on a culvert (operated intermittently to drain water from the interior), and south of the cross levee at a levee breach repair site consisting of large boulders. The upper elevational limit of non-wetland waters of the U.S. is either: (1) the transition to non-tidal freshwater perennial emergent wetlands or riparian wetlands, or (2) the transition to uplands (generally at the 6.5-ft elevation contour line [NAVD88]).

Non-tidal freshwater perennial emergent wetland

Non-tidal freshwater perennial emergent wetlands within the north property are also subject to jurisdiction under Section 404 of the CWA. Indicators of hydric soils present at the site include hydrogen sulfide and loamy gleyed matrix. Indicators of wetland hydrology include high water table, saturation, and hydrogen sulfide odor. The upper limit of this wetland community was either at the transition to valley/foothill riparian wetland or the transition to upland habitats (generally the 6.5-ft elevation contour line [NAVD88]).

Tidal freshwater emergent wetland

Because the degraded breach repair located south of the cross levee provides limited tidal exchange between the south property and Miner Slough, portions of the south property at elevations below 6.5 ft (NAVD88) were mapped as tidal freshwater emergent wetlands subject to jurisdiction under Section 404 of the CWA. Because this connection provides only limited tidal exchange and does not allow fish passage or fully support associated tidal habitat functions, non-tidal natural community types were assigned to aquatic habitats below MHHW within the interior portions of the south property (Table 2.2-2).

Valley/Foothill riparian wetland

Valley/foothill riparian wetlands within the Project site are subject to jurisdiction under Section 404 of the CWA because they meet all three wetland criteria; i.e., they have positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology. Indicators of hydric soils present at the site include loamy gleyed matrix, depleted matrix, redox dark surface, and redox depressions. Indicators of wetland hydrology include high water table, saturated soils, dry-season water table, and oxidized rhizospheres along living roots. Valley/foothill riparian woodland is present on higher elevation areas (> 6.5-ft elevation contour line [NAVD88]) of the levees, adjacent to Valley/foothill riparian wetlands; however, these areas did not meet the jurisdictional wetlands criteria and were thus not delineated as wetlands.

Special-status species

Special-status plants

Review of the California Natural Diversity Database (CNDDB)(CDFW 2014c), California Native Plant Society's Online Inventory of Rare, Threatened, and Endangered Plants of California (CNPS 2014) and U. S. Fish and Wildlife Service's Species List Generator] (USFWS 2013) identified 47 special-status plant species known to occur or with the potential to occur in the vicinity of Prospect Island (Table 3.4-2). Based on the habitat needs of these species, current habitat conditions at the Project site, and focused botanical surveys conducted in the summer of 2014 (Appendix E), 11 species were determined to have moderate or high potential to occur within the Project site. These species are discussed in further detail below.

Table 3.4-2. Special-status Plant Species with the Potential to Occur in the Proposed Project Vicinity

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Ferris' milk-vetch *Astragalus tener* var. *ferrisiae*	CNPS, CNDDB	– /– /1B.1	April– May	7–246	Vernally mesic soils in meadows and seeps and subalkaline flats in valley and foothill grassland	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
alkali milk-vetch *Astragalus tener* var. *tener*	CNPS, CNDDB	– /– /1B.2	March– June	3–197	Playas, adobe clay in valley and foothill grassland, and alkaline vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
heartscale *Atriplex cordulata* var. *cordulata*	CNPS, CNDDB	– /– /1B.2	April– October	0–1,837	Saline or alkaline soils in chenopod scrub, meadows and seeps, and sandy soils in valley and foothill grassland	**Low;** valley and foothill grassland habitat may be present but is highly disturbed	No	**Low;** valley and foothill grassland habitat would continue to be present but it would continue to be highly disturbed

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
crownscale *Atriplex coronata* var. *coronata*	CNPS	– /– /4.2	March–October	3–1,936	Alkaline, often clay soils in chenopod scrub, valley and foothill grassland, and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
brittlescale *Atriplex depressa*	CNPS, CNDDB	– /– /1B.2	April–October	3–1,050	Alkaline or clay soils in chenopod scrub, meadows and seeps, playas, valley and foothill grassland	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
San Joaquin spearscale *Atriplex joaquinana*	CNPS, CNDDB	– /– /1B.2	April–October	3–2,740	Alkaline soils in chenopod scrub, meadows and seeps, playas, valley and foothill grassland	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
vernal pool smallscale *Atriplex persistens*	CNPS, CNDDB	– /– /1B.2	June–October	33–377	Alkaline soils in vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
big tarplant *Blepharizonia plumosa*	CNPS, CNDDB	– /– /1B.1	July–October	98–1,657	Valley and foothill grassland, usually in clay soils	**None;** outside of the elevation range	No	**None;** outside of the elevation range
watershield *Brasenia schreberi*	CNPS, CNDDB	– /– /2B.3	June–September	98–7,218	Freshwater marshes and swamps	**None;** outside of the elevation range	No	**None;** outside of the elevation range
round-leaved filaree *California macrophylla*	CNPS, CNDDB	– /– /1B.1	March– May	49–3,937	Clay soils in cismontane woodland and valley and foothill grassland	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
bristly sedge *Carex comosa*	CNPS, CNDDB	– /– /2B.1	May–September	0–2,051	Coastal prairie, lake margins, marshes and swamps, and valley and foothill grassland	**Moderate;** marshes present; valley and foothill grassland habitat may be present but is highly disturbed	Yes, tidal influence introduced	**Moderate;** potential habitat would still be available. Hydrologic connectivity may increase colonization potential within the Project site
pappose tarplant *Centromadia parryi* subsp. *parryi*	CNPS, CNDDB	– /– /1B.2	May–November	0–1,378	Often alkaline soils in chaparral, coastal prairie, meadows and seeps, coastal salt marshes and swamps, and vernally mesic valley and foothill grassland	**None;** suitable habitat not present	No, the tidal influence would not be enough to create coastal salt marsh habitat	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Parry's rough tarplant *Centromadia parryi* subsp. *rudis*	CNPS	– /– /4.2	May–October	0–328	Alkaline, vernally mesic soils in, seeps, sometimes roadsides, valley and foothill grassland and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
soft bird's-beak *Chloropyron molle* subsp. *molle* [*Cordylanthus mollis* subsp. *mollis*]	CNPS, CNDDB, USFWS	FE/CR/1B.2	July–November	0–10	Coastal salt marshes and swamps	**None;** suitable habitat not present	No, the tidal salinities would be too low to create tidal salt marsh habitat	**None;** suitable habitat would not be created
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	CNPS, CNDDB	– /– /2B.1	July–September	0–656	Coastal, fresh or brackish water marshes and swamps	**Moderate;** freshwater marshes present	Yes, tidal influence introduced	**Moderate;** freshwater marshes present

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Hoover's cryptantha *Cryptantha hooveri*	CNPS, CNDDB	– /– /1A	April–May	30–492	Inland dunes, valley and foothill grassland in sandy soils	**Low;** slightly outside of the elevation range	No	**Low;** slightly outside of the elevation range
dwarf downingia *Downingia pusilla*	CNPS, CNDDB	– /– /2B.2	March– May	3–1,460	Mesic soils in valley and foothill grassland and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
Antioch Dunes buckwheat *Eriogonum nudum* var. *psychicola*	CNPS, CNDDB	– /– /1B.1	July–October	0–66	Inland dunes	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
Mt. Diablo buckwheat *Eriogonum truncatum*	CNPS, CNDDB	– /– /1B.1	April–September (November), (December),	10–1,148	Sandy soils in chaparral, coastal scrub, and valley and foothill grassland	**Low;** valley and foothill grassland habitat may be present is but highly disturbed	No	**Low;** valley and foothill grassland habitat would continue to be present but would continue to be highly disturbed

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	CNPS, CNDDB, USFWS	FE/CE/1B.1	March–July	10–66	Inland dunes	**None;** suitable habitat not present and critical habitat outside of the Project site	No	**None;** suitable habitat would not be created
diamond-petaled California poppy *Eschscholzia rhombipetala*	CNPS, CNDDB	– /– /1B.1	March–April	0–3,199	Alkaline, clay soils in valley and foothill grassland	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
fragrant fritillary *Fritillaria liliacea*	CNPS, CNDDB	– /– /1B.2	February–April	10–1,345	Often serpentinite soils in cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland	**Low;** valley and foothill grassland habitat may be present on non-serpentine soils but is highly disturbed	No	**Low;** valley and foothill grassland habitat would continue to be present but it would continue to be highly disturbed

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
adobe-lily *Fritillaria pluriflora*	CNDDB	– /– /1B.2	February–April	60–705	Often adobe soils in chaparral, cismontane woodland, and valley and foothill grassland	**None;** outside of the elevation range	No	**None;** outside of elevation range
Boggs Lake hedge-hyssop *Gratiola heterosepala*	CNPS, CNDDB	– /CE/1B.2	April–August	33–7,792	Clay soils in marshes and swamps, lake margins and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
woolly rose-mallow *Hibiscus lasiocarpos* var. *occidentalis*	CNPS, CNDDB	– /– /1B.2	June–September	0–394	Freshwater marshes and swamps	**Moderate;** habitat present	Yes, tidal influence introduced	**High;** Hydrologic connectivity may increase colonization potential within the Project site
Carquinez goldenbush *Isocoma arguta*	CNPS, CNDDB	– /– /1B.1	August–December	3–66	Alkaline soils in valley and foothill grassland	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Northern California black walnut *Juglans hindsii*	CNPS, CNDDB	– /– /1B.1	April–May	0–1,444	Riparian forest and riparian woodland	**None;** habitat present however the CNDDB documented occurrence in the Proposed Project region was extirpated and any other black walnuts in the area are likely of hybrid origin and thus not protected	No	**None;** habitat present however recruits are unlikely given hybridization issues
Contra Costa goldfields *Lasthenia conjugens*	CNPS, CNDDB, USFWS	FE/– /1B.1	March–June	0–1,542	Mesic soils in cismontane woodland, alkaline playas, valley and foothill grassland, and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	CNPS, CNDDB	– /– /1B.2	May– July (September)	0–13	Freshwater and brackish marshes and swamps	**High;** one occurrence is documented on the neighboring Ryer Island; 40 additional occurrences are documented in the Proposed Project region (CNDDB)	Yes, tidal influence introduced	**High;** species documented adjacent to the Project site and hydrologic connectivity may increase colonization potential within the Project site
legenere *Legenere limosa*	CNPS, CNDDB	– /– /1B.1	April–June	3–2,887	Vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
Heckard's pepper-grass *Lepidium latipes* var. *heckardii*	CNPS, CNDDB	– /– /1B.2	March–May	7–656	Alkaline flats in valley and foothill grasslands	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Mason's lilaeopsis *Lilaeopsis masonii*	CNPS, CNDDB	– /CR/1B.1	April–November	0–33	Brackish or freshwater marshes and swamps and riparian scrub	**High;** two occurrences are documented in the Project site; 102 additional occurrences are documented in the Proposed Project region (CNDDB)	Yes, tidal influence introduced	**High;** species already documented in the Project site and hydrologic connectivity may increase colonization potential within the Project site
Delta mudwort *Limosella australis*	CNPS, CNDDB	– /– /2B.1	May–August	0–10	Usually mud banks of freshwater or brackish marshes and swamps, and riparian scrub	**Moderate;** one occurrence is documented near the Project site; 37 additional occurrences are documented in the Proposed Project region (CNDDB)	Yes, tidal influence introduced	**High;** hydrologic connectivity may increase colonization potential within the Project site
showy golden madia *Madia radiata*	CNPS	– /– /1B.1	March– ay	82–3,986	Cismontane woodland and valley and foothill grassland	**None;** outside of the elevation range	No	**None;** outside of the elevation range

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
little mousetail *Myosurus minimus* subsp. *apus*	CNPS	– /– /3.1	March–June	66–2,100	Alkaline soils in valley and foothill grassland and vernal pools	**None;** outside of the elevation range	No	**None;** outside of the elevation range
Baker's navarretia *Navarretia leucocephala* subsp. *bakeri*	CNPS, CNDDB	– /– /1B.1	April–July	16–5,709	Mesic soils in cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
Colusa grass *Neostapfia colusana*	CNPS, CNDDB, USFWS	FT/CE/1B.1	May–August	16–656	Adobe soils in large vernal pools	**None;** suitable habitat not present and critical habitat outside of the Project site	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Antioch Dunes evening-primrose *Oenothera deltoides* subsp. *howellii*	CNPS, CNDDB, USFWS and critical habitat	FE/CE/1B.1	March–September	0–98	Inland dunes	**None;** suitable habitat not present and critical habitat outside of the Project site	No	**None;** suitable habitat would not be created
bearded popcorn-flower *Plagiobothrys hystriculus*	CNPS, CNDDB	– /– /1B.1	April–May	0–899	Mesic soils in valley and foothill grassland, vernal pool margins and often vernal swales	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created
eel-grass pondweed *Potamogeton zosteriformis*	CNPS, CNDDB	– /– /2B.2	June–July	0–6,102	Assorted freshwater marshes and swamps	**Moderate;** habitat present	Yes, tidal influence introduced	**Moderate;** although additional habitat would be present, there is only one occurrence ten miles to the south of the Proposed Project

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Sanford's arrowhead *Sagittaria sanfordii*	CNPS, CNDDB	– /– /1B.2	May–October	0–2,133	Assorted shallow freshwater marshes and swamps	**Moderate;** four occurrences are documented near the Project site (CNDDB; DWR, unpubl. data); 7 additional occurrences are documented in the Proposed Project region (CNDDB)	Yes,tidal influence introduced	**High;** hydrologic connectivity may increase colonization potential within the Project site
marsh skullcap *Scutellaria galericulata*	CNPS, CNDDB	– /– /2B.2	June–September	0–6,890	Lower montane coniferous forest, mesic meadows and seeps, and marshes and swamps	**Moderate;** marshes present	Yes, tidal influence introduced	**Moderate;** hydrologic connectivity may increase colonization potential within the Project site; nearest occurrence is 7 miles to the east/northeast (J. Witzman, pers. comm., January 2014)

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
side-flowering skullcap *Scutellaria lateriflora*	CNPS, CNDDB	– /– /2B.2	July–September	0–1,640	Mesic meadows and seeps, and marshes and swamps	**Moderate;** marshes present	Yes, tidal influence introduced	**Moderate;** hydrologic connectivity may increase colonization potential within the Proposed Project; site nearest occurrences are seven miles to the east/southeast
Keck's checkerbloom *Sidalcea keckii*	CNPS, CNDDB, USFWS	FE/– /1B.1	April– May (June)	246–2,133	Serpentinite and clay soils in cismontane woodland, and valley and foothill grassland	**None;** outside the elevation range	No	**None;** outside the elevation range

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Suisun Marsh aster *Symphyotrichum lentum*	CNPS, CNDDB	– /– /1B.2	May–November	0–10	Brackish and freshwater marshes and swamps	**High;** four occurrences are documented in the Project site (CNDDB); 94 additional occurrences are documented in the Proposed Project region	Yes, tidal influence introduced	**High;** species already documented in the Project site and hydrologic connectivity may increase colonization potential within the Project site
saline clover *Trifolium hydrophilum*	CNPS, CNDDB	– /– /1B.2	April–June	0–984	Marshes and swamps (specifically saltmarsh according to Baldwin et al.[4]), mesic, alkaline soils in valley and foothill grassland, and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

Common name Scientific name	Query sources	Status[1]: Federal/ State/ CRPR	Blooming period	Elevation range (ft)	Suitable habitat type	Likelihood of occurrence in the Project site under current conditions[2]	Enhanced conditions post restoration? (preliminary assessment)	Likelihood of occurrence in the Project site under post-restoration conditions[3]
Crampton's tuctoria or Solano grass *Tuctoria mucronata*	CNPS, CNDDB, USFWS	FE/CE/1B.1	April–August	16–33	Mesic soils in valley and foothill grassland and vernal pools	**None;** suitable habitat not present	No	**None;** suitable habitat would not be created

1 Status:

–	=	None
Federal		
FE	=	Endangered under the ESA
FT	=	Threatened under the ESA
State		
CE	=	Endangered under the CESA
CR	=	Rare under the Commission on National Parks and Protected Areas
CRPR (California Rare Plant Ranks)		
1A	=	Plants presumed extirpated in California and either are or extinct elsewhere
1B	=	Plants rare, threatened, or endangered in California and elsewhere
2B	=	Plants rare, threatened, or endangered in California, but more common elsewhere
3	=	Plants for which more information is need –a review list
4	=	Plants of limited distribution –a watch list
0.1	=	Seriously threatened in California
0.2	=	Moderaely threatened in California
0.3	=	Not very threatened in California

2 Likelihood for a special-status species to occur in the Project site under current conditions is defined as follows:

- None: the species' required habitat (i.e., plant community types and elevation range) is lacking from the Project site.
- Low: the species' required habitat occurs in the Project site but it is of very low quality.
- Moderate: the species' required habitat occurs in the Project site.
- High: the species has been documented in the Project site.

3 Likelihood for a special-status species to occur in the Project site under post-restoration conditions is defined as follows:

- None: the species' required habitat is lacking from the Project site and restoration would not create this habitat.

Bristly Sedge (*Carex comosa*) is a California Rare Plant Ranks (CRPR) List 2.1 herbaceous perennial that flowers between May and September. Bristly sedge occurs along lake margins and waterside edges in freshwater wetlands and wetland-riparian habitats. Appropriate habitat exists within the Project site in the non-tidal freshwater perennial emergent wetland vegetation communities on the interior of the island, and on the tidally influenced exterior of the island within tidal perennial emergent wetland and valley/foothill riparian natural communities. The closest recorded occurrences of bristly sedge are approximately 7.5 miles east at Delta Meadows State Park. A second occurrence is located farther east at Delta Meadows State Park.

Bolander's water hemlock (*Cicuta maculata var. bolanderi*) is a CRPR List 2.1 herbaceous perennial that flowers between July and September. Bolander's water hemlock occurs in salt marsh and wetland-riparian habitats, and appropriate habitat exists within the Project site on the island's tidally influenced exterior within tidal perennial emergent wetland and valley/foothill riparian natural communities. The closest recorded occurrences of Bolander's water hemlock are approximately 6 miles west of Prospect Island in Lindsey Slough.

Woolly rose-mallow (*Hibiscus lasiocarpos var. occidentalis*) is a CRPR 1B.2 herbaceous perennial that flowers from June to September. The plant occurs in freshwater wetland and riparian habitats. Appropriate habitat exists within the Project site in non-tidal freshwater perennial emergent wetland natural communities on the interior of the island, and on the tidally influenced exterior of the island within tidal perennial emergent wetland and valley/foothill riparian natural communities. The closest recorded occurrence of woolly rose mallow is located approximately 4 miles west of Prospect Island in Steamboat Slough. Other nearby occurrences have been recorded in Lindsey Slough and Hass Slough to the west.

Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) is a CRPR 1B.2 herbaceous perennial that flowers between May and July. This plant occurs in freshwater and brackish marsh and riparian habitats, although it is usually restricted to areas with tidal influence. Suitable habitat for delta tule pea exists within the Project site in the non-tidal freshwater perennial emergent wetland natural community on the interior of the island, and in tidal perennial emergent wetland and valley/foothill riparian natural communities on the tidally influenced exterior of the island. The closest occurrence of delta tule pea is located on Ryer Island, just across Miner Slough from the southern tip of Prospect Island. Other nearby occurrences are located to the west on Lindsey Slough and Cache Slough.

Mason's lilaeopsis (*Lilaeopsis masonii*) is listed by the state of California as rare, and is a CRPR 1B.1 herbaceous perennial that flowers between April and November. The plant occurs in riparian, freshwater marsh and brackish marsh habitats, and is usually restricted to areas with tidal influence. Appropriate habitat exists within the tidal perennial emergent wetland and valley/foothill riparian natural communities on the exterior of Prospect Island. Mason's lilaeopsis was found on the Project site in the spur channel. The next closest recorded occurrence of Mason's lilaeopsis is located at the southern tip of Prospect Island, with additional occurrences in the DWSC, and in Hass, Cache, and Lindsey Sloughs on the west side of the island.

Delta mudwort (*Limosella australis*) is a CRPR 2B.1 perennial stoloniferous herb that flowers between May and August. The plant usually occurs on mud banks in freshwater or brackish marshes or swamps, or riparian scrub, and is usually restricted to areas with tidal influence. Suitable habitat exists within the tidal perennial emergent wetland and valley/foothill riparian natural communities on the exterior of Prospect Island. The closest recorded occurrence of delta mudwort is located at the southern tip of Prospect Island, with additional nearby occurrences along Lindsey Slough to the west and the Sacramento River to the south.

Eelgrass pondweed (*Potamogeton zosteriformis*) is a CRPR 2.2 herbaceous aquatic annual that flowers between June and July. This plant occurs in wetlands and wetland-riparian natural communities. Appropriate habitat exists within the Project site in non-tidal perennial aquatic and non-tidal freshwater perennial emergent wetland natural communities on the interior of the island, and on the tidally influenced exterior of the island within tidal perennial aquatic and tidal perennial emergent wetland natural communities. The closest recorded occurrence of eelgrass pondweed was observed in 1949 near Webb Tract, located about 10 miles south of Prospect Island.

Sanford's arrowhead (*Sagittaria sanfordii*) is a CRPR 1B.2 rhizomatous perennial herb that flowers from May through October. This plant occurs in freshwater wetlands and wetland-riparian natural communities. Appropriate habitat exists within the Project site in non-tidal freshwater perennial emergent wetland natural communities on the interior of the island, and on the tidally influenced exterior of the island within tidal perennial emergent wetland and valley/foothill riparian natural communities. There are several recorded occurrences of Sanford's arrowhead located in Miner Slough which borders

Prospect Island on its eastern side. Other nearby occurrences are located on the Sacramento River to the south, and Steamboat Slough to the east.

Marsh skullcap (*Scutellaria galericulata*) is a CRPR 2.2 rhizomatous perennial herb that flowers from June through September. This plant occurs in meadows and freshwater marsh in yellow pine forest, freshwater wetlands and wetland-riparian habitats. Appropriate habitat exists within the Project site in non-tidal freshwater perennial emergent wetland communities on the interior of the island, and on the tidally influenced exterior of the island within tidal perennial emergent wetland and valley/foothill riparian natural communities. The closest recorded occurrences are located over 8.5 miles west of Prospect Island at Delta Meadows State Park, and to the south near Staten Island and at Franks Tract State Recreation Area.

Side-flowering skullcap (*Scutellaria lateriflora*) is a CRPR 2.2 rhizomatous perennial herb that flowers from July through September. This plant occurs in meadows and freshwater marsh in freshwater wetlands and wetland-riparian habitats, and is often found growing on woody debris located in the intertidal zone. Appropriate habitat exists within the Project site in non-tidal freshwater perennial emergent wetland natural communities on the interior of the island, and on the tidally influenced exterior of the island within tidal perennial emergent wetland and valley/foothill riparian natural communities. The closest recorded occurrences of side-flowering skullcap are located about 8.5 miles east of Prospect Island at Delta Meadows State Park, with additional occurrences further south to Bouldin Island

Suisun Marsh aster (*Symphyotrichum lentum*) is a CRPR 1B.2 rhizomatous perennial herb that flowers from May through November. This plant occurs in freshwater and brackish marshes and wetland-riparian habitats, and is usually restricted to areas with tidal influence. Suitable habitat exists within the tidal perennial emergent wetland and valley/foothill riparian natural communities on the exterior of Prospect Island. Suisun Marsh aster has been recorded or observed in all waterways surrounding Prospect Island, with an extensive record of additional occurrences throughout the Sacramento-San Joaquin Delta, stretching from San Pablo Bay inland toward the city of Stockton.

Special-status Wildlife Species

Special-status wildlife species were identified as having low, moderate, or high potential to occur at the Project site (Table 3.4-3). The likelihood of these species occurring at the site was determined by: (1) surveys conducted by DWR between

2009 and 2011; (2) presence and extent of potential habitat; and/or (3) proximity to known occurrences, such as from CNDDB (CDFW 2014c) or the eBird online portal used to report bird sightings (eBird 2013). This review and analysis resulted in the following categories potential for a special-status species to occur:

- None: the Project site is outside the species' known range and/or the species' required habitat is lacking from the Project site.
- Low: the species' known range overlaps with the Proposed Project vicinity but not the Project site, and/or the species' required habitat is of very low quality or quantity in the Project site; documented sightings of the species in the Proposed Project vicinity are rare, if any.
- Moderate: The species' known distribution or elevation range overlaps with the Project site and the species' required habitat occurs in the Project site; there is also a reasonable chance for the species to occur based on frequency of documented sightings in the Proposed Project vicinity.
- High: The species has been documented on the Project site and/or its required habitat occurs on the Project site and is of high quality.

Seven special-status species have a high potential to occur or are known to occur at the site: western pond turtle, Northern Harrier, Swainson's Hawk, Yellow Warbler, Yellow-breasted Chat, Song Sparrow ("Modesto" population), and western red bat. Any potential impacts to these and other special-status species whose critical habitat is on the Project site are discussed in this section.

Table 3.4-3. Special-status Wildlife Species Document in the Proposed Project Vicinity

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
INVERTEBRATES							
Conservancy fairy shrimp *Branchinecta conservatio*	USFWS, CNDDB, DWR et al.	FE/–	Disjunct occurrences in Tehama, Glenn, Butte, Yolo, Solano, Stanislaus, Merced, and Ventura counties	Large, deep vernal pools in annual grasslands	**None**; there is no vernal pool habitat at the Project site	No	**None**; no vernal pool habitat would be created
Longhorn fairy shrimp *Branchinecta longiantenna*	DWR et al.	FE/–	Four known populations in San Luis Obispo, Merced, Alameda, and Contra Costa counties	Vernal pools; also found in sandstone rock outcrop pools, grass-bottomed pools, and claypan pools	**None**; the Project site is outside of the species' known range	No	**None**; the Project site is outside of the species' known range
Vernal pool fairy shrimp *Branchinecta lynchi*	USFWS, CNDDB, DWR et al.	FT/– Critical habitat (Designated)	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County; isolated populations also in Riverside County	Vernal pools; also found in sandstone rock outcrop pools	**None**; there is no vernal pool habitat at the Project site	No	**None**; no vernal pool habitat would be created
Vernal pool tadpole shrimp *Lepidurus packardi*	USFWS, CNDDB, DWR et al.	FE/– Critical habitat (Designated)	Shasta County south to Merced County	Vernal pools and ephemeral stock ponds	**None**; there is no vernal pool habitat at the Project site	No	**None**; no vernal pool habitat would be created

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	USFWS, CNDDB, DWR et al.	FT/–	Streamside habitats throughout the Central Valley	Riparian and oak savanna habitats below 3,000 ft with host plant *Sambucus nigra* ssp. *caerulea* (blue elderberry)	**Low**; the Project site is likely outside of the species' known range; elderberry plants were observed during surveys in December 2013, and no exit holes were observed (J. Downs, CDFW, pers. comm. 2014)	No	**Low**; the Project site is likely outside of the species' known range
Delta green ground beetle *Elaphrus viridus*	USFWS, CNDDB, DWR et al.	FT/– Critical habitat (Designated)	Only known to occur in Solano County	Grassland habitat interspersed with vernal pools	**None**; there is no vernal pool habitat at the Project site	No	**None**; no vernal pool habitat would be created
Lange's metalmark butterfly *Apodemia mormo langei*	USFWS, CNDDB	FE/–	Antioch Sand Dunes in Contra Costa County	Dunes; larval food plant is nakedstem buckwheat (*Eriogonum nudum* ssp. *auriculatum*); adult nectar plants include buckwheat, butterweed (*Senecio douglasii*), and snakeweed (*Gutierrezia divergens*)	**None**; the Project site is outside of the species' known range	No	**None**; the Project site is outside of the species' known range

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
AMPHIBIANS							
California red-legged frog *Rana draytonii*	USFWS	FT/SSC Critical habitat (Designated)	Largely restricted to coastal drainages on the central coast from Mendocino County to Baja California; in the Sierra Nevada foothills south to Tulare and possibly Kern counties	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow-moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat	**None**; the Project site is outside of the species' known range	No	**None**; the Project site is outside of the species' known range
California tiger salamander *Ambystoma californiense*	USFWS, CNDDB, DWR et al.	FT/ST Critical habitat (Designated)	Very fragmented; along the coast from Sonoma County to Santa Barbara County, in the Central Valley and Sierra foothills from Sacramento County to Tulare County	Grassland, oak savannah, or edges of woodland that provide subterranean refuge (typically mammal burrows); breeds in nearby temporary ponds, vernal pools, or slow-moving parts of streams	**None**; there is no suitable upland habitat at the Project site	No	**None**; no suitable upland habitat would be created

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
REPTILES							
Western pond turtle *Actinemys marmorata*	CNDDB, DWR et al.	–/SSC	From the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting	**High**; there is suitable non-tidal perennial aquatic habitat present at the Project site; nesting habitat present on dry levees and uplands; commonly sighted in the Delta	Yes, marshes enhanced	**High**; suitable marsh habitat present and would be enhanced
California legless lizard *Anniella pulchra*	CNDDB	–/SSC	Northern Contra Costa County south to northwestern Baja California; scattered occurrences in San Joaquin Valley, along the southern Sierra Nevada mountains, and in the western Mojave Desert	Sparsely vegetated areas of beach dunes, chaparral, pine-oak woodlands, desert scrub, sandy washes, and stream terraces; warm, moist, loose soil for burrowing	**None**; the Project site is outside of the species' known range and there is no suitable habitat at the Project site	No	**None**; the Project site is outside of the species' known range

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Giant garter snake *Thamnophis gigas*	USFWS, CNDDB, DWR et al.	FT/ST	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno	Sloughs, canals, low-gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter	**Low**; this species was not detected during trapping surveys in 2009, though there is suitable habitat present; emergent marsh provides foraging habitat and levees provide winter upland retreat from flooding	No	**Low**; habitat condition suitable, within historic range, few individuals have been detected within the Delta
BIRDS							
Redhead *Aythya americana*	DWR et al.	–/SSC (nesting)	Summer resident; breeds in northeastern California, Central Valley, southern coasts, and southern desert	Freshwater emergent wetlands with dense stands of cattails (*Typha* spp.) and bulrush (*Schoenoplectus* spp.) interspersed with areas of deep, open water; forage and rest on large, deep bodies of water	**Low**; permanent freshwater emergent wetland at the Project site may provide suitable breeding habitat; rarely documented in Central Valley, and prefer larger lakes for nesting	No	**Low**; habitat would not be enhanced; this species is rarely documented in the Central Valley

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Least Bittern *Ixobrychus exilis*	DWR et al.	–/SSC (nesting)	Primarily a summer resident; breeds in northeastern California, Central Coast, Central Valley, southern coasts, and southern deserts	Freshwater and brackish marshes with dense aquatic or semiaquatic vegetation interspersed with clumps of woody vegetation and open water	**Low**; permanent freshwater emergent wetland at the Project site may provide suitable breeding habitat, though species is rare in the Delta	No	**Low**; while habitat present, this species is rarely detected in the Delta
White-tailed Kite *Elanus leucurus*	CNDDB, DWR et al.	–/SFP (nesting)	Year-round resident; found in nearly all lowlands of California west of the Sierra Nevada mountains and the southeast deserts	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area	**Moderate**; may nest in large riparian trees at the Project site, and use emergent marsh and grasslands for foraging	No	**Moderate**; riparian forest nesting habitat present but would be reduced in area.
Northern Harrier *Circus cyaneus*	CNDDB, DWR et al.	–/SSC (nesting)	Year-round resident; scattered throughout California.	Nests, forages, and roosts in wetlands or along rivers or lakes, but also in grasslands, meadows, or grain fields	**High**; documented nesting and foraging at the Project site	No	**High**; suitable nesting and foraging habitat present but reduced in area
Swainson's Hawk *Buteo swainsoni*	CNDDB, DWR et al.	–/ST (nesting)	Summer resident; breeds in lower Sacramento and San Joaquin valleys, the Klamath Basin, and Butte Valley.	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields	**High**; nesting documented in riparian forest habitats at the Project site	No	**High**; suitable riparian forest nesting habitat present.

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Golden Eagle *Aquila chrysaetos*	DWR et al.	BGEPA/SFP (nesting and wintering)	Uncommon permanent resident and migrant throughout California, except center of Central Valley	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or large trees	**None**; no suitable nesting habitat on or near Project site	No	**None;** no suitable nesting habitat would be created
California Black Rail *Laterallus jamaicenis coturniculus*	CNDDB, DWR et al.	–/ST, SFP	Marshes of San Francisco Bay (primarily San Pablo and Suisun Bay), Sacramento-San Joaquin Delta, Sierra Nevada foothills, few in central coast and southeastern California	Primarily large tidal saline to brackish wetlands with dense vegetative cover and sufficient elevation for high tide refugia; in the Delta: in-channel islands with mixed emergent wetland (Schoenoplectus sp.) and riparian scrub-shrub (Salix sp., Cornus sp.), managed marsh, or irrigated pasture with emergent wetland vegetation	**Low**; No black rails were encountered during 2014 surveys; water levels in the Project site are too deep to support black rail	No	**Low**; a majority of the tidal marsh would remain too deep and would not have appropriate elevation to support nesting.
Ridgway's Rail *Rallus obsoletus*	USFWS, DWR et al.	FE/SE, SFP	Predominantly in marshes in San Francisco Bay, and sporadically in Suisun Marsh east to Browns Island	Salt and brackish water marshes, typically dominated by pickleweed (*Sarcocornia pacifica*) and Pacific cordgrass (*Spartina foliosa*)	**None**; outside the species' known range	No	**None**; outside the species' known range

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Greater Sandhill Crane *Grus canadensis tabida*	DWR et al.	–/ST, SFP (nesting and wintering)	Winter visitor and migrant; scattered locations in the Central Valley; breeds in extreme northeastern California	Forages in harvested rice fields, corn stubble, barley, and newly planted grain fields; occasionally in managed freshwater marshes	**Low** (wintering/foraging only); the Project site is on the edge of the species' known range; low potential to forage in freshwater emergent wetland habitats	No	**Low**; the Project site is on the edge of the species' known range; tidal habitat does not provide suitable roosting habitat for the species
Mountain Plover *Charadrius montanus*	CNDDB, DWR et al.	FPT/SSC (wintering)	Winter visitor; found in the Central Valley south of Yuba County and parts of Central and South Coast and Southeastern California	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grain fields	**None**; no suitable habitat at the Project site	No	**None**; no suitable grassland habitat would be created
California Least Tern *Sternula antillarum browni*	USFWS, DWR et al.	FE/SE, SFP (nesting colony)	Pacific coast from San Francisco to Baja California	Sparsely vegetated coastal beaches and estuaries near shallow waters, above high tide line	**None**; no suitable habitat at the Project site	No	**None**; no suitable estuarine habitat would be created

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Western Yellow-billed Cuckoo *Coccyzus americanus*	CNDDB, DWR et al.	FC/SE (nesting)	Breeds in limited portions of the Sacramento River and the South Fork Kern River; small populations may nest in Butte, Yuba, Sutter, San Bernardino, Riverside, Inyo, Los Angeles, and Imperial counties	Summer resident of valley/foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation	**Low**; rare in the Proposed Project vicinity; low probability of nesting	No	**Low**; while habitat present, this species is rare in the Proposed Project vicinity
Western Burrowing Owl *Athene cunicularia hypugaea*	CNDDB, DWR et al.	–/SSC (burrow sites and some wintering sites)	Year-round resident throughout much of the state; Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Level, open, dry, heavily grazed or low- stature grassland or desert vegetation with available burrows	**Low;** limited availability of suitable nesting or foraging habitat in grasslands at western perimeter of Project site along dry levees and uplands	No	**Low**; grassland habitat would continue to be present in the Project site but extent would still be limited

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Short-eared Owl *Asio flammeus*	DWR et al.	–/SSC (nesting)	Year-round resident in certain areas; breeding in California episodic and a widespread winter migrant, found primarily in the Central Valley, in the western Sierra Nevada foothills, and along the coastline	Irrigated alfalfa or grain fields, ungrazed grasslands, old pastures, and salt or freshwater marshlands	**Moderate**; Not documented during 2009 or 2014 surveys; may forage in permanent freshwater emergent marsh and upland habitats, primarily in winter; very low potential for nesting at the Project site due to limited upland breeding sites or suitable dry nest sites in wetlands.	No	**Moderate;** suitable nesting and foraging habitat present but reduced in area
Loggerhead Shrike *Lanius ludovicianus*	DWR et al.	–/SSC (nesting)	Year-round resident in most of California except for the forested coastal slope and the high elevations of the Sierra Nevada, southern Cascade, and Transverse Ranges	Open shrubland or woodlands with short vegetation and and/or bare ground for hunting; some tall shrubs, trees, fences, or power lines for perching; typically nest in isolated trees or large shrubs	**Low**; Not documented during 2009 or 2014 surveys; may nest in isolated shrubs at the Project site, though suitability of foraging habitat is marginal	No	**Low**; limited suitable nesting or foraging habitat

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Least Bell's Vireo *Vireo bellii pusillus*	DWR et al.	FE/SE (nesting)	Summer resident; breeds in scattered locations around southern California. There is some evidence that the species may be recovering in the Central Valley	Nests in dense vegetative cover of riparian areas; often nests in willow or mulefat; forages in dense, stratified canopy	**Low**; while this species is a rare migrant in the Proposed Project vicinity, there is evidence that the species could be increasing in the Central Valley; one recent nesting record in restored habitat at San Joaquin River National Wildlife Refuge, and recent documented singing males in Yolo Bypass Wildlife Area	No	**Low**; suitable habitat present but would be reduced in area; the species is rare in the Proposed Project vicinity

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Bank Swallow *Riparia riparia*	CNDDB, DWR et al.	–/ST (nesting)	Summer resident; occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American rivers; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou counties; small populations near the coast from San Francisco County to Monterey County	Nests in vertical bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam	**None**; no suitable vertical bank habitat at the Project site	No	**None**; no suitable vertical bank habitat would be created
Yellow Warbler *Dendroica petechia*	DWR et al.	–/SSC (nesting)	Summer resident; nests in most of California, except most of the Central Valley, high Sierras, and Mojave and Colorado deserts	Open-canopy, deciduous riparian woodland close to water, along streams or wet meadows	**Moderate to High**; documented during summer in riparian scrub-shrub at the Project site (breeding status unknown); the Project site is outside of what is considered the species' current breeding range (Heath 2008)	No	**Moderate to High**; riparian forest nesting habitat present but would be reduced in area

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Saltmarsh Common Yellowthroat *Geothlypis trichas sinuosa*	CNDDB, DWR et al.	–/SSC	San Francisco Bay region	Brackish marsh, riparian woodland/swamp, freshwater marsh, and salt marsh often near upland habitats	**None**; outside the species' known breeding range	No	**None**; outside the species' known breeding range
Yellow-breasted Chat *Icteria virens*	DWR et al.	–/SSC (nesting)	Uncommon summer resident and migrant in coastal California and in foothills of the Sierra Nevada	Early-successional riparian habitats with a dense shrub layer and an open canopy	**High**; although the Delta is considered outside the species' breeding range (Comrack 2008), observations during breeding season at the Project site and the Delta indicate the species likely nests in the region (National Audubon Society 2013)	No	**High**; riparian forest habitat present but would be reduced in area
Grasshopper Sparrow *Ammodramus savannarum*	CNDDB, DWR et al.	–/SSC (nesting)	Summer resident; nests in Mendocino, Trinity, and Tehama counties south, west of the Cascade–Sierra Nevada axis and southeastern deserts, to San Diego County	Typically found in moderately open grasslands with scattered shrubs	**Low**; grassland habitats at the Project site are limited and of marginal quality.	No	**Low**; grassland habitat would continue to be present in the Project site but extent would still be limited

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Song Sparrow (“Modesto” population) *Melospiza melodia*	DWR et al.	–/SSC	Year-round resident; north-central portion of the Central Valley	Emergent freshwater marshes, riparian willow thickets, and riparian forests	**High**; sightings common throughout the Project site during 2009 and 2014 surveys, including nesting	No	**High**; marsh nesting and foraging habitat present but would be reduced in area
Suisun Song Sparrow *Melospiza melodia maxillaris*	CNDDB	–/SSC	Resident of Suisun Bay	Brackish-water marshes	**None**; outside the species’ known range	No	**None**; outside the species’ known range
Tricolored Blackbird *Agelaius tricolor*	CNDDB, DWR et al.	–/SSC (nesting colony)	Permanent resident, but makes extensive migrations both in breeding season and winter; common locally throughout Central Valley and in coastal areas from Sonoma County south	Feeds in grasslands and agriculture fields; nesting habitat components include open accessible water, a protected nesting substrate (including flooded or thorny vegetation), and a suitable nearby foraging space with adequate insect prey	**Low**; while permanent freshwater emergent wetland at the Project site may provide suitable breeding habitat, breeding colonies are uncommon in the Proposed Project vicinity.	No	**Low**; while habitat present, this species is uncommon in the Proposed Project vicinity

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	CNDDB, DWR et al.	–/SSC (nesting)	Primarily a migrant and summer resident, though small numbers remain in winter; Central Valley, northeastern California, central and southern coasts, and southern deserts	Breeds almost entirely in open marshes with relatively deep water and tall emergent vegetation, such as bulrush (*Schoenoplectus* spp.) or cattails (*Typha* spp.); nests are typically in moderately dense vegetation; forage within wetlands and surrounding grasslands and croplands	**Low;** while permanent freshwater emergent wetland at the Project site may provide suitable breeding habitat, breeding is uncommon in the Proposed Project vicinity; emergent marsh provides foraging habitat	No	**Low;** while habitat present and would be enhanced, this species is uncommon in the Proposed Project vicinity
MAMMALS							
Salt marsh harvest mouse *Reithrodontomys raviventris*	USFWS, CNDDB	FE/SE, SFP	San Pablo, Suisun, and San Francisco bays in Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo counties	Tidal salt marshes; depend on dense cover, preferring pickleweed (*Salicornia pacifica*) and saltgrass	**None**; outside the species' known range	No	**None**; outside the species' known range

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
Western red bat *Lasiurus blossevillii*	CNDDB, DWR et al.	–/SSC	Near the Pacific Coast, Central Valley, and the Sierra Nevada	Riparian forests, woodlands near streams, fields and orchards	**High**; species detected during acoustic monitoring in 2009; roosting habitat throughout riparian forest at the Project site, including maternity roosts	Yes	**High**; riparian forest roosting habitat present
San Joaquin kit fox *Vulpes macrotis mutica*	USFWS	FE/ST/BLMS	San Joaquin Valley floor and surrounding foothills of the coastal ranges, Sierra Nevada, and Tehachapi mountains	Annual grasslands or open areas dominated by scattered brush, shrubs, and scrub	**None**; no suitable habitat at the Project site	No	**None**; no suitable grassland habitat would be created
American badger *Taxidea taxus*	CNDDB	–/SSC	Throughout the state except in the humid coastal forests of Del Norte County and the northwest portion of Humboldt County	Shrubland, open grasslands, fields, and alpine meadows with friable soils	**None**; no suitable habitat at the Project site	No	**None**; no suitable grassland habitat would be created

Common name Scientific name	Query sources	Status[1] Federal/ State	Distribution in California	Habitat association	Likelihood to occur[2] at the Project site under current conditions	Restoration enhances conditions for species?	Likelihood to occur in the Project site under post-restoration conditions
California ringtail *Bassariscus astutus raptor*	Zeiner et al. 1990a	–/SFP	Widely distributed, though greatest abundance in northern California and Sierra Nevada foothills	Mixture of forest and shrub habitats in association with rocky areas or riparian habitats, low to middle elevations	**Low**; very little is known about this species in this region; may occur in riparian trees at the Project site, though there is a lack of connectivity to other riparian areas	No	**Low**; the species is uncommon in the Delta; as restoration and habitat connectivity increases, likelihood for occurrence could increase

1 Status codes:

Federal
FE = Listed as endangered under the federal Endangered Species Act
FT = Listed as threatened under the federal Endangered Species Act
FC = Federal candidate species
FSC = Federal Species of Concern

State
SE = Listed as Endangered under the California Endangered Species Act
ST = Listed as Threatened under the California Endangered Species Act
SSC = California Species of Special Concern
SFP = CDFW Fully Protected species

2 Sources: (Appendix 12C in DWR et al. 2013); 2014 bird surveys (Appendix F). Likelihood for species to occur at the Project site:

- None: the Project site is outside the species' known range and/or the species' required habitat is lacking from the Project site.
- Low: the species' known range overlaps with the project region but not the Project site, and/or the species' required habitat is of very low quality or quantity in the Project site; documented sightings of the species in the Proposed Project region are rare, if any.
- Moderate: The species' known distribution or elevation range overlaps with the Project site and the species' required habitat occurs in the Project site; there is also a reasonable chance for the species to occur based on frequency of documented sightings in the Proposed Project region.
- High: The species has been documented in the Project site and/or its required habitat occurs in the Project site, is of high quality, and documented sightings of the species in the Proposed Project region are common.

Special-status invertebrates

Several special-status invertebrate species are known to occur within the study area; however, all but one of the species require vernal pool, alkali seasonal wetland, or sand dune habitats that are absent from the project site. Due to lack of suitable habitat on the Project site, these species have no potential to occur and are not further addressed in this document: Conservancy fairy shrimp (*Branchinecta conservatio*), Longhorn fairy shrimp (*Branchinecta longiantenna*), Vernal pool fairy shrimp (*Branchinecta lynchi*), Vernal pool tadpole shrimp (*Lepidurus packardi*), Delta green ground beetle (*Elaphrus viridis*), and Lange's metalmark butterfly (*Apodemia mormo langei)*.

Valley elderberry long horn beetle

The valley elderberry long horn beetle, a federally listed threatened species, is completely dependent on its host plant, elderberry (*Sambucus* spp.), a common shrub of riparian forests and adjacent upland habitats in the Central Valley. The host plant for this species occurs on site in several locations; however, the project site is believed to be outside the range of this species. The two closest occurrences of this species are located 13.6 miles from the project site: a 1991 occurrence along Dudley Creek, just east of Pedrick Road, 0.1 mile north of Dixon Ave, just east of Dixon, and a 1987 occurrence 2.25 miles east of Franklin Field along the Cosumnes River (CDFW 2014c). Within the primary zone of the Delta, there is one known occurrence from 1984 along Wing Levee Road between Howard and Undine Roads on Union Island near Middle River, approximately 30 miles southwest of the Project site.

A protocol level survey on April 16 and 24, 2014, conducted in accordance with the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a) identified seven elderberry shrubs on site. The shrubs were of sufficient size to provide habitat for the beetle but no indicators of extant presence (recently created exit holes) were detected. Argentine ants, known to prey upon beetle larvae, were observed on several of the shrubs on site (J. Downs, pers. comm, 2014). The Project site is over 13 miles from the nearest known population of the beetle. The lack of recorded occurrences in the vicinity of the Project site and the relative abundance of the host plant in the delta indicate that the elderberry shrubs on site are unlikely to be potential habitat for the beetle.

Special-status reptiles

Habitat for two special-status reptile species occurs on the project site: giant garter snake (*Thamnophis gigas*), a federal and state listed threatened species; and western pond turtle (*Actinemys marmorata*), a California Species of Special

Concern. Habitats for other amphibian or reptile species are known to occur in Solano, Yolo, or Sacramento counties, but do not exist on the Project site and therefore are not considered further in this document. These species include: California tiger salamander (*Ambystoma californiense*), California red-legged frog (*Rana draytonii*), and California legless lizard (*Anniella pulchra*).

Giant garter snake

The giant garter snake resides in marshes, ponds, sloughs, small lakes, low-gradient streams, and other waterways, and in agricultural wetlands, including irrigation and drainage canals, rice fields, and adjacent uplands (USFWS 1993a). Primary habitat requirements of the giant garter snake include the following: (1) adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, accompanied by vegetated banks for escape cover and foraging habitat during the active season; (3) basking habitat of grassy banks and openings in waterside vegetation; and (4) higher elevation uplands for cover and refuge from flood waters during the snake's winter dormant season (Hansen and Brode 1980, Hansen 1986, USFWS 2012). In some rice-growing areas, giant garter snakes have adapted well to vegetated, artificial waterways and associated rice fields (Hansen and Brode 1993). Throughout its winter dormancy period, the giant garter snake resides in small mammal burrows and soil crevices located above prevailing flood elevations (USFWS 2012). Burrows are typically located in sunny exposures along south- and west-facing slopes (USFWS 1993a).

Occurrence records indicate that giant garter snakes are currently distributed in 13 unique population clusters coinciding with historical flood basins, marshes, wetlands, and tributary streams of the Central Valley (Hansen and Brode 1980; Brode and Hansen 1992; USFWS 1999b). These populations are isolated, without protected dispersal corridors to other adjacent populations, and are threatened by land use practices and other human activities, including development of wetland and suitable agricultural habitats. The Project site is within the Mid-Valley Recovery Unit identified in the draft recovery plan and near the Yolo-Liberty Farms population cluster (USFWS 1999b). Hansen (1988) reported that although the major permanent waterways of the Delta are apparently unsuitable for the giant garter snake, small backwater sloughs and toe drains support suitable habitat for, and thus could potentially support, small numbers of giant garter snakes.

The U.S. Geological Survey (USGS) conducted surveys for giant garter snake in 2004 and 2005 in the southern portion of the Yolo Basin near Cache Slough between Liberty Island and Lower Ulatis Creek in Solano County (Wylie and Martin 2005). Surveys were conducted in areas that supported habitat similar to known occupied sites and in areas where several historical occurrences were apparently reported. No giant garter snakes were found during these surveys (Wylie and Martin 2005).

While suitable habitat continues to persist along natural streams and artificial channels throughout much of the Delta, historical and recent occurrence records based on a substantial survey effort suggest two primary geographic areas that retain extant populations and probably a greater likelihood of potential occurrence and re-establishment of populations. These include the Yolo Bypass and vicinity west of the DWSC and the eastern Delta fringe from approximately the Stone Lakes area south to Stockton and generally east of the Mokelumne River (Appendix 2.A.28 in DWR 2013b).

There are five CNDDB occurrences for giant garter snake within a 10-mile radius of the Project site (CDFW 2014c), the closest being less than 5 miles to the northwest. While a few other isolated records also occur within the Sacramento-San Joaquin Delta, surveys conducted since the mid-1980s suggest that much of the Delta is unoccupied or supports few giant garter snakes. Giant garter snakes may have occupied this region at one time, but longstanding reclamation of wetlands for intense agricultural applications has eliminated most suitable habitat (Hansen 1986) and prohibited the reestablishment of viable giant garter snake breeding populations.

Larger areas of suitable habitat for giant garter snake developed at Prospect Island as a result of the latest levee breach in 2006, when pumping water off site was discontinued. Currently, Prospect Island exhibits the primary components of suitable aquatic and upland habitat for giant garter snake, including non-tidal perennial emergent wetlands, shallow open water areas, riparian scrub wetland, and upland habitats in the form of grassland and valley foothill riparian communities on levees and berms. These existing habitats provide potential basking and brumation (i.e., a hibernation-like state that cold-blooded animals utilize during very cold weather) sites for giant garter snake.

In 2009, limited surveys were conducted for giant garter snake on Prospect Island as part of the BDCP EIR/EIS surveys (Appendix 12C in DWR et al. 2013). During this limited survey effort no giant garter snakes were observed or captured. Other snake species were observed during the survey efforts, including two unidentified garter snakes, one common garter snake, one gopher snake, and one yellow-

bellied racer. While the survey effort resulted in a lack of evidence that giant garter snake occurs on site, the surveys confirmed the presence of other snake species, some of which utilize similar habitat as giant garter snake.
Despite exhibiting the primary components of suitable habitat, Prospect Island appears to provide habitat of marginal quality for giant garter snake, which is likely due to a combination of factors: periodic large flood events, the presence of non-native marsh plant species, and high densities of predatory fish. As stated previously, the marsh habitat currently present on Prospect Island was created by a levee breach in 2006, which was itself one in a series of flood and drain occurrences at the Project site since the mid-1990s. As part of the Yolo Bypass Flood Control Project, the Project site is surrounded by restricted height levees that are designed to overtop in high flood conditions. Repeated breaching and intensive flooding of Prospect Island is not desirable for the giant garter snake or the habitats it utilizes because flooding can impact giant garter snake individuals that may be overwintering in upland habitat and typicaly drowns the emergent marsh the species uses for foraging and cover.

Additionally, non-native invasive plants are found throughout the Project site; there are currently 75–100 ac of verified *Ludwigia spp.* stands and many more acres of potential mixed stands (Figure 3.4-1) (SWS and WWR 2013) that do not provide ideal habitat for the species. The thick stands may provide edge habitat for the species but the interior of those stands may be avoided by giant garter snake. Lastly, perennial aquatic areas of the Project site are occupied by high densities of predatory fish in all surveyed areas of the site (CDFW, unpubl. data 2013 to present). While predatory fish do not directly threaten adult giant garter snakes, they can prey upon juvenile snakes, threatening the overall recruitment of the species, should adults attempt to reproduce on the site. Combined, these factors may explain why the recent (2009) survey effort resulted in a lack of evidence that giant garter snake occurs at Prospect Island.

Western pond turtle

The western pond turtle is usually found in still or slow-moving freshwater habitats and sometimes in brackish habitats. Primarily found in natural aquatic habitats, the species also inhabits impoundments, irrigation ditches, and other artificial water bodies with suitable basking sites, underwater cover, and riparian vegetation (Zeiner et al. 1988).

Historically, western pond turtles inhabited most water bodies throughout their range, but the series of warm, shallow lakes and extensive slough systems that formerly covered most of the floor of the Central Valley represented their optimal habitat (Jennings et al. 1992). Western pond turtles are common throughout many parts of the Delta, including island interiors, particularly main irrigation and drainage canals or ditches, including toe drains. The species has the potential to occur along most of the slower-moving sloughs and other water bodies in the Project site where essential habitat elements (streamside cover, logs, and other debris for basking, and adjacent upland habitats) are present.

Upland habitats are also important to western pond turtles for nesting, overwintering, and overland dispersal (Holland 1994). Nesting sites may be 1,320 feet from aquatic habitat, although the distance is generally around 650 feet (Jennings and Hayes 1994). The turtle can move up to 1.25 miles from aquatic habitat and can tolerate at least 7 days without water if local aquatic habitat changes or disappears (Jennings and Hayes 1994). Dispersal habitat is similar to upland nesting habitat but also includes agricultural land. Grasslands and riparian areas provide western pond turtle upland nesting and overwintering habitat.

Western pond turtle is known to occur within the Project Site. During BDCP EIR/EIS surveys on the Project site, there were incidental observations of western pond turtles while conducting surveys for listed vernal pool invertebrate species and giant garter snake, but exact locations were not given (Appendix 12C in DWR et al. 2013). Western pond turtles were observed in the remnant slough channel between Hall's Island and Prospect Island on April 24, 2014 during protocol level valley elderberry longhorn beetle surveys.

Special-status birds

Prospect Island contains a variety of habitats, including riparian and emergent wetland habitats which have experienced declines of up to 90 percent loss statewide; the Project site comprises one of the larger contiguous emergent wetlands in the Proposed Project vicinity (approximately 1,100 ac, see Table 2.2-2), as well as 145 ac of valley/foothill riparian habitat that hosts a diverse bird community. Surveys conducted at Prospect Island revealed 87 bird species associated with the habitats at the site (Appendix F). Resident species such as Northern Harrier (*Circus cyaneus*), American Bittern (*Botaurus lentiginosus*), Virginia Rail (*Rallus limicola*), Mallard (*Anas platyrhynchos*), Double-crested Cormorant (*Phalacrocorax auritus*), Pied-billed Grebe (*Podilymbus podiceps*), Song Sparrow (*Melospiza melodia*), Red-winged Blackbird (*Agelaius phoeniceus*), Common Yellowthroat (*Geothlypis trichas*), and Marsh Wren (*Cistothorus palustris*) used freshwater emergent wetland and perennial habitats; Mourning Dove (*Zenaida macroura*), Great Horned Owl (*Bubo virginianus*), American Robin (*Turdus migratorius*), and Nuttall's Woodpecker (*Picoides nuttallii*) used riparian habitats; and Western Meadowlark (*Sturnella neglecta*) and American Goldfinch (*Carduelis tristis*) used ruderal grassland habitats. Several migratory species used Prospect Island during spring and fall migration, including Western Tanager (*Piranga ludoviciana*), Black-bellied Plover (*Pluvialis squatarola*), and Western Sandpiper (*Calidris mauri*). Neotropical migrant species that nested at Prospect Island include Swainson's Hawk (*Buteo swainsoni*), Tree Swallow (*Tachycineta bicolor*), Black-headed Grosbeak (*Pheucticus melanocephalus*), Yellow-breasted Chat (*Icteria virens*), and Wilson's Warbler (*Wilsonia pusilla*). Non-native, invasive species such as Eurasian Collared Dove (*Streptopelia decaocto*), European Starling (*Sturnus vulgaris*), Great-tailed Grackle (*Quiscalus mexicanus*), and Brown-headed Cowbird (*Molothrus ater*) were also recorded at Prospect Island.

Special-status Species with a high or moderate likelihood of occurring at the Project site under current conditions and after restoration are discussed in detail below.

Special-status bird species found within the study area that have low to no potential to occur due to lack of suitable habitat at the Project site are not considered further in this document. These species include: Redhead (*Aythya americana*), Least Bittern (*Ixobrychus exilis*), Golden Eagle (*Aquila chrysaetos*), Ridgway's Rail (*Rallus obsoletus*), Greater Sandhill Crane (*Grus canadensis tabida*), Mountain Plover (*Charadrius montanus*), California Least Tern (*Sterna antillarum browni*), Western Yellow-billed Cuckoo (*Coccyzus americanus*), Western Burrowing Owl (*Athene cunicularia hypugaea*), Loggerhead Shrike (*Lanius ludovicianus*), Bank Swallow (*Riparia riparia*), Saltmarsh Common Yellowthroat (*Geothlypis trichas sinuosa*), Grasshopper Sparrow (*Ammodramus savannarum*), Suisun Song Sparrow (*Melospiza melodia maxillaris*), and Tricolored Blackbird (*Agelaius tricolor*).

Northern Harrier (*Circus cyaneus*)

Northern Harrier, a California Species of Special Concern (nesting birds), is a marsh-associated ground-nesting bird that is commonly found within the Delta year-round. The breeding population now appears to be restricted to north coastal lowlands, the central coast, the northern Central Valley, Klamath Basin, and Great Basin (MacWhirter and Bildstein 1996, Davis and Niemela 2008). Meadows, marshes, and wetlands are optimal habitat types; other suitable habitats include grasslands, ungrazed or lightly grazed pastures, and grain fields (Davis and Niemela 2008). Northern Harriers nest on the ground in shrubby vegetation, usually along the edge of marshes. Nests are constructed of larger plants (e.g., willows, cattails) at the base with grasses and sedges lining the interior. Northern

Harriers feed primarily on voles or other small mammals; birds, frogs, reptiles, and invertebrates make up the rest of their diet (MacWhirter and Bildstein 1996). This highly territorial species breeds from April through September, with peak breeding occurring during June and July (Zeiner et al. 1990b).

Within the Project site, suitable nesting habitat exists on the dry fringe and higher elevation areas without standing water within the 1,100-ac non-tidal freshwater emergent wetland habitat; foraging habitat exists in non-tidal freshwater emergent and in ruderal grassland habitat (approximately 54 ac, Table 2.2-2). DWR documented four occurrences of Northern Harriers nesting in wetland habitats habitats at the northeastern end of Prospect Island (Appendix 12C in DWR et al. 2013, Appendix F). Two more nest sites were documented on fallow agricultural land on adjacent islands just outside of the Project site, one to the north and one to the east of the Project site (Appendix 12C in DWR et al. 2013). Northern Harriers are very common in the Proposed Project vicinity.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's Hawk is a California Threatened species (nesting birds) whose nesting range includes the Central Valley, northeastern California, and the Great Basin, and migrates south during winter. Swainson's Hawks nest primarily in mature riparian trees with relatively dense canopies such as oaks or cottonwoods, also in scattered or isolated trees in rural or residential areas near foraging habitat (Schlorff and Bloom 1984, England et al. 1997). They forage in grasslands and in agricultural lands such as alfalfa, irrigated pasture, and grains. Prey is dominated by rodents, primarily voles, gophers, and deer mice, but the species also forages opportunistically for reptiles, birds, and insects (CDFG 1994).

Within the Project site, nesting habitat exists in valley/foothill riparian habitats; suitable foraging habitat in ruderal grassland is limited. There are multiple documented sightings of Swainson's Hawks in riparian habitats on the Project site by CNDDB and DWR, at least three of which included signs of nesting (Appendix 12C in DWR et al. 2013, Appendix F). There is a high density of nesting Swainson's Hawks in the Proposed Project vicinity (Appendix 12C in DWR et al. 2013).

White-tailed Kite (*Elanus leucurus*)

White-tailed Kite is a State Fully Protected species (nesting birds) distributed throughout the western hemisphere; however, the majority of North American residents occur in California. They inhabit low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands and agricultural areas for foraging (Dunk 1995). Nesting occurs in trees with dense canopies located near foraging habitat from February to August. Within the Project site, suitable nesting and foraging habitat exists in valley/foothill riparian and ruderal grassland habitats. The closest CNDDB occurrence of White-tailed Kite is 5 miles northeast of the Project site (CDFW 2014c).

Short-eared Owl (*Asio flammeus*)

The Short-eared Owl is a California Species of Special Concern (nesting birds) that breeds throughout the State, including portions of the Sacramento and San Joaquin valleys, and in northeastern and coastal California. The species nests on the ground among herbaceous vegetation such as the dry fringe and higher elevation areas without standing water within freshwater marsh and seasonal wetlands, wet meadows, fallow fields, and alfalfa fields and forages at night in marshes, grasslands, agricultural fields primarily for voles, but also would take small birds as prey (Roberson 2008).

Within the Project site, suitable nesting and foraging habitat exists in non-tidal freshwater perennial emergent wetland habitats. Surveys conducted by DWR staff did not detect Short-eared Owls using the Project site (Appendix 12C in DWR et al. 2013, Appendix F). The closest CNDDB occurrence of Short-eared Owl is 15 miles southwest of the Project site (CDFW 2014c).

Yellow Warbler (*Dendroica petechia*)

Yellow Warbler, a California Species of Special Concern (nesting birds), is a summer resident that breeds throughout much of California, except the Central Valley, southern Californian deserts, and high Sierra Nevada (Zeiner et al. 1990b; Heath 1998, 2008). The largest concentrations of breeding pairs occur in northeastern California, in Modoc National Forest and Shasta County, as well as in the Cascade Range and Sierra Nevada (Heath 2008). The species has been extirpated from most of the southern Sacramento and San Joaquin valleys. The preferred habitat of Yellow Warbler includes open-canopy or deciduous riparian vegetation, often along streams or wet meadows (Heath 2008). This species frequently nests in small willows and alders, and is also associated with cottonwoods, Oregon ash, and other riparian shrubs and trees, depending upon the geographic region (Zeiner et al. 1990b, Heath 2008). Breeding occurs from mid-April through early August, with peak activity in June (Zeiner et al. 1990b). Birds forage for insects within the shrub and tree canopy, occasionally feeding on the wing or eating fruit (Zeiner et al. 1990b, Lowther et al. 1999).

Within the Project site, suitable nesting and foraging habitat exists in valley/foothill riparian habitats. DWR documented a Yellow Warbler singing in riparian scrub-shrub on the Project site along Miner Slough in 2009 (Appendix 12C in DWR et al. 2013), which may indicate breeding. This species has not commonly been documented in the Proposed Project vicinity (eBird 2013), and the Project site is considered outside of the species' current breeding range (Heath 2008).

Yellow-breasted Chat (*Icteria virens*)

Yellow-breasted Chat, a California Species of Special Concern (nesting birds), is a summer resident of the Cache-Yolo region. This species breeds in scattered locations around southern California, and there have been recent sightings in Central Valley. Yellow-breasted Chats nest and forage in dense riparian thickets of willows, vines, and brush associated with streams and other wetland habitats (Eckerle et al. 2001). Population density is directly related to shrub density (Crawford et al. 1981), with a preference for blackberry (Kroodsma 1982, Burnett and DeStaebler 2003), although a variety of other shrubs and thickets are considered suitable, including wild grape, willows, and California wild rose (Melhop and Lynch 1986, Annand and Thompson 1997, Ricketts and Kus 2000, Comrack 2008). Some taller overstory trees are also required for song perches (Eckerle et al. 2001), but mature and dense overstory canopies are apparently avoided (Kroodsma 1982, Melhop and Lynch 1986, Annand and Thompson 1997, Comrack 2008).

Within the Project site, suitable nesting and foraging habitat exists in valley/foothill riparian habitats. Several Yellow-breasted Chats were documented using riparian scrub-shrub at the southern end of Prospect Island in 2009 (Appendix 12C in DWR et al. 2013). Survey data indicate that the species is found in the Delta in much greater numbers than was previously thought (Appendix 12C in DWR et al. 2013). Pairs of Yellow-breasted Chat at Liberty Island, Sherman Island, and Piper Slough have also been observed in the central Delta (National Audubon Society 2013).

Song Sparrow (*Melospiza melodia*, "Modesto" population)

The "Modesto" population of Song Sparrow (hereafter referred to as Modesto Song Sparrow), is ubiquitous in the Delta. Modesto Song Sparrow, a California Species of Special Concern, was a valid subspecies until 2001 and may be again after additional taxonomic analysis (Gardali 2008). The population is endemic to the north-central portion of the Central Valley and the Bay-Delta is one of two areas with the highest population densities. The Modesto Song Sparrow occupies wetland, riparian, and scrub habitats, as well as most agricultural habitats along associated drains. Emergent marsh and riparian scrub provide primary nesting habitat (Gardali 2008).

Within the Project site, suitable nesting and foraging habitat exists in non-tidal freshwater perennial emergent wetland, valley/foothill riparian, and ruderal grassland habitats. Many nesting Song Sparrows, presumed to belong to the "Modesto" population based on location, were documented nesting in riparian scrub-shrub, riparian trees, and marsh habitats along the perimeter of Prospect Island (CDFW 2013, Appendix 12C in DWR et al. 2013, Appendix F). This species is commonly documented in the Proposed Project vicinity (eBird 2013).

Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)

Yellow-headed Blackbird is a State Species of Special Concern (nesting birds) that resides year-round in California; it nests in the Central Valley, northeastern California, and portions of southern California, but winters in western and northern Mexico. The species nests colonially in densely vegetated freshwater emergent wetlands with deep water, often along borders of lakes or ponds and forages in agricultural fields and pastures with abundant insect prey (Jaramillo 2008).

Within the Project site, suitable nesting and foraging habitat exists in non-tidal freshwater perennial emergent wetland habitats, but surveys conducted by DWR staff did not detect Yellow-headed Blackbird using the Project site (Appendix 12C in DWR et al. 2013, Appendix F). The nearest record of Yellow-headed Blackbird nesting is more than 15 miles north of the Project site in the Yolo Bypass Wildlife Area (Yolo Natural Heritage Program 2009).

California Black Rail (*Laterallus jamaicensis coturniculus*)

The California Black Rail is a State Threatened and Fully Protected species that resides year-round in northern San Francisco Bay, Suisun Marsh, the Sacramento-San Joaquin Delta, with isolated populations in the Sierra Nevada foothills, Morro Bay, and southeastern California. During winter, the species' range expands to throughout San Francisco Bay and coastal Marin County. The species nest in saline, freshwater, or brackish emergent marshes above the high tide line with adjacent upland refugia, and also use managed emergent marshes or emergent marshes associated with seeps with dense vegetative cover (Eddleman et al. 1994).

Within the Project site, suitable nesting and foraging habitat exists in non-tidal freshwater perennial emergent wetland habitats, however water levels are too deep for the species throughout much of the site. Black Rail surveys conducted by

DWR staff did not detect rails using the Project site (Appendix 12C in DWR et al. 2013, Appendix F). The nearest record of Black Rail is approximately 6 miles west of the Project site on the Lindsey Slough Habitat Enhancement Project site (S. Estrella, pers. comm., 2014).

Least Bell's Vireo (*Vireo bellii pusillus*)

Least Bell's Vireo is a federal and State Endangered species (nesting birds) that formerly nested throughout the Sacramento and San Joaquin valleys and coastal valleys and foothills of central and southern California. Due to habitat loss, the Least Bell's Vireo has been extirpated from most of this range. Least Bell's Vireos nest in dense thickets of willows and other riparian shrubs near water or intermittent streams and migrates south in the winter (Kus 2002). The species was recently recorded nesting in Kern County, Yolo Wildlife Area in Yolo County, and may re-establish nesting within the Central Valley in the future.

Within the Project site, suitable nesting and foraging habitat exist in valley/foothill riparian habitats. Surveys conducted by DWR staff did not detect Least Bell's Vireo using the Project site (Appendix 12C in DWR et al. 2013, Appendix F). The nearest record of Least Bell's Vireo is 15.5 miles north of the Project site on the Yolo Bypass Wildlife Area (CDFW 2014c).

Other avian species

Species that currently occur at the Project site that are of management concern but do not have State or Federal protection, as well as species that do not currently occur, but have a high or moderate likelihood of occurring after restoration include:

American Bittern (*Botaurus lentiginosus*) is a USFWS species of management concern and is included on the National Audubon Society's Blue List (USEPA 2003) that resides year-round throughout the Central Valley. American Bittern nests in dense freshwater emergent wetland habitats with open water, and is secretive and difficult to observe. Populations have declined since the 1960s due to habitat loss and degradation (Lowther et al. 2009). Within the Project site, suitable nesting and foraging habitat exists in non-tidal freshwater emergent wetland habitats. Surveys conducted by DWR staff detected American Bittern using the Project site (Appendix F) and the nearby Liberty Island Ecological Reserve.

Double-crested Cormorant (*Phalacrocorax auritus*; CDFW Watch list species for nesting colonies), Great Blue Heron (*Ardea herodias*; California Department of

Forestry Sensitive species for nesting colonies), Great Egret (*Ardea alba*; California Department of Forestry Sensitive species for nesting colonies), and Snowy Egret (*Egretta thula*; California Department of Forestry Sensitive species for nesting colonies) all nest in rookeries (colonial nest sites in large trees), often in mixed species groups, and forage in a variety of habitats including open water, edges of emergent wetlands, agricultural ditches, irrigated pasture, and agricultural fields. Snowy Egret also nests on mats of vegetation in tule-dominated wetlands.

Within the Project site, suitable nesting habitat exists in riparian trees and snags. Surveys conducted by DWR staff recorded Double-crested Cormorant, Great Blue Heron, Great Egret, and Snowy Egret foraging at the Project site, but no rookeries were observed (Appendix 12C in DWR et al. 2013, Appendix F). The nearest heron or cormorant rookery is approximately 0.25 miles west of the Project Site at the nearby Liberty Island Ecological Reserve (Appendix 12C in DWR et al. 2013).

Special-status mammal species

Species with a high or moderate likelihood of occurring at the Project site under current conditions and after restoration are discussed in detail below.

<u>Western red bat (*Lasiurus blossevillii*)</u>

The western red bat is listed as a California Species of Special Concern and occur throughout the Central Valley. The western red bat is closely associated with riparian habitat, especially mature stands of cottonwood and sycamore, which provides suitable roosting sites in trees and sometimes shrubs. There is evidence for seasonal movements by western red bats in California, but little evidence for mass migration characteristics (Pierson et al. 2006). The distribution of males and females in California differ seasonally. Males are dispersed throughout the State during maternity season, while females are concentrated in the Central Valley (Peirson et al. 2006). Based on the habitat requirements of western red bats for breeding and the vast majority of breeding records for the species occur in the Central Valley, it is likely that the western red bat uses the Project site as maternity roosting habitat. The species feeds on a variety of insects, primarily moths, crickets, beetles, and cicadas, often in large groups and over a variety of areas including grasslands, shrublands, open woodlands, and cropland (Zeiner et al. 1990a).

Western red bat was documented on the Project site during the 2009 BDCP EIR/EIS habitat assessments and acoustic monitoring surveys conducted by DWR (Appendix 12C in DWR et al. 2013) and habitat was re-verified within the

Project site during a site visit in 2014. Western red bats were detected in each session, indicating that they are present in some numbers the majority of the year, but most likely present in the largest numbers during maternity season (May through August).

Other bat species

Species that currently occur at the Project site that are of management concern but do not have State or Federal protection, are discussed in briefly below.

Hoary bat (*Lasiurus cinereus*) and silver-haired bat (*Lasionycteris noctivagans*) are Western Bat Working Group Medium Priority species (Western Bat Working Group 2007). Both species use large trees for roosts, with the hoary bat preferring to roost in dense foliage and the silver-haired bat preferring tree hollows and snags. Both species were detected on Prospect Island during 2009 surveys (Appendix 12C in DWR et al. 2013). Both species feed over open areas including open water, streams, edge habitats, and open brushy areas. Due to the similar life history requirements of these species, any impact analysis for western red bat would also be applicable to these species.

Legal and regulatory setting

Federal laws

Multiple federal programs are applicable to the regulation and protection of wetland and terrestrial resources in the Project site, as discussed below. The CWA and the Rivers and Harbors Act of 1899 are discussed in Section 3.2.2. Unless otherwise noted, the Proposed Project would comply with the following federal laws.

Endangered Species Act

The federal ESA of 1973, as amended, establishes a national program for conservation (survival and recovery) of species listed as threatened or endangered, and the ecosystems on which they depend. USFWS and NMFS are responsible for implementing this act. Federally-listed plants, wildlife, and non-anadromous fish species are regulated by USFWS, and federally-listed, anadromous fish species and (most) marine mammals are regulated by NMFS.

The federal ESA Section 7 requires that federal agencies consult with USFWS or NMFS if their actions may affect a federally-listed species or destroy or adversely modify critical habitat. This section also prohibits any federal agency from taking actions likely to jeopardize the survival and recovery of listed species. Issuance of a federal permit is one type of action that may trigger the Section 7 consultation.

USFWS or NMFS concludes formal Section 7 consultation with the issuance of a BiOp, which may also include an incidental take statement. The statement provides authorization for incidental take (e.g., indirect killing, harm, harassment, injury) of listed fish or wildlife species that is otherwise prohibited by Section 9 of the federal ESA. USFWS and NMFS may also conclude informal consultation with the issuance of a letter of concurrence.

Migratory Bird Treaty Act

The federal MBTA of 1918, as amended (16 USC Section 703 - 711) provides for the protection of migratory birds by making it illegal to possess, hunt, pursue, or kill any migratory bird, or any transaction pertaining to any wild migratory bird, part, nest, egg or product, manufactured or not, unless specifically authorized by the Secretary of the Interior. Currently, there are roughly 1,007 species on the list of migratory birds.

Executive Orders

Executive Order No. 11990 (Protection of Wetlands) requires federal agencies to provide leadership to protect the natural and beneficial values served by wetlands. Federal agencies are directed to minimize the destruction or degradation of wetlands.

Executive Order No. 13112 (Invasive Species) inaugurated the National Invasive Species Management Plan and National Invasive Species Council policy direction to promote coordination between federal, state, and local agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. Specifically the Executive Order calls on all Federal agencies to identify actions they take which may affect the status of invasive species and use relevant programs and authorities to prevent introduction, detect and respond rapidly to invasive species, monitor invasive species populations, provide for restoration of native species, and promote public education. In addition, the Executive Order provides:

> "…an agency should not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and

prudent measures to minimize risk of harm would be taken in conjunction with the actions."

State laws and regulations

Multiple state programs are applicable to the regulation and protection of wetland and terrestrial resources in the Project site. The Porter-Cologne Water Quality Act is discussed in Section 3.2.2. Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

California Endangered Species Act

The state counterpart to the federal ESA, California ESA (CFG Code Section 2050 *et seq.*) has similar, but distinct requirements and goals. CESA requires state agencies to coordinate with the CDFW to ensure that state-authorized or state-funded actions do not jeopardize a state-listed species. The state list of species classified as rare, threatened, or endangered does not necessarily correspond with the federal list of threatened and endangered species.

The state code also includes a less familiar legal status for some species as fully protected. As originally written, prohibitions against take of older fully protected species were more stringent and inflexible than those of CESA, generally prohibiting nearly all take. However, recent California legislation authorizes CDFW to permit the incidental take of 36 fully protected species pursuant to an approved natural community conservation plan (Senate Bill 618 [Wolk].) The legislation, in effect, gives fully protected species the same level of protection as is provided under the Natural Community Conservation Planning Act for endangered and threatened species (CFG Code Section 2835). The legislation also removes a substantial regulatory barrier to the development of regional conservation plans under the Natural Community Conservation Planning Act.

California Fish and Game Code

Under Section 1600 - 1616 of the California Fish and Game Code, CDFW regulates activities that would alter the flow, bed, channel, or bank of streams and lakes. The limits are as the "… bed, channel or bank of any river, stream, or lake designated by the department in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit ..." (Section 1601). Undertaking stream-altering activities that may adversely affect fish or wildlife would require an applicant to enter into an agreement with CDFW for authorization for up to five years.

Native Plant Protection Act

The NPPA (CFG Code Section 1900 *et seq.*) designates 64 species, subspecies, and varieties of native California plants as rare. NPPA prohibits take of rare native plants, but includes some exceptions for agricultural and nursery operations; emergencies; and after properly notifying CDFW for vegetation removal from canals, roads, and other sites, changes in land use, and in certain other situations.

Delta Reform Act

With the passage of SB 7x-1, the Delta Reform Act established coequal goals of a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem as overarching state policy. Furthermore, the Act established the policy of reducing reliance on the Delta in meeting California's future water supply needs. Federal agencies are also committed to the coequal goals, thus setting a new course for water management in the state. Drawing on information and experiences gained during the CALFED process, the Delta Reform Act created the Delta Stewardship Council (DSC) with the authority and responsibility to develop the Delta Plan, and to ensure that actions by state and local agencies in the Delta are consistent with the Plan. The DSC was directed to adequately incorporate the best available science and adaptive management principles, to improve decision-making and reduce stakeholder conflict. The DSC also was empowered to coordinate and collaborate across the myriad governmental agencies that have responsibility for some aspect of the Delta (Delta Stewardship Council 2013). With over three years of government coordination and public input, the Delta Plan adopted May 2013 relies on a mix of legally enforceable policies and essential recommendations to prioritize actions and strategies for improved water management, ecosystem restoration, and levee maintenance. It also identifies actions that may cause harm, and provides regulatory guidance for all major plans, projects, and programs in the Delta (Delta Stewardship Council 2013).

Executive Orders

Executive Order W-59-93 (California Wetlands Conservation Policy) establishes substantive environmental goals to ensure no overall net loss of wetlands; to achieve a long-term net gain in the quantity, quality, and permanence of wetlands in California; and to provide due consideration for private property and stewardship.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local ordinances and policies.

Solano County General Plan

The following two strategies for natural resources articulated in the Solano County General Plan (Solano County Board of Supervisors 2008) are relevant to wetland and terrestrial biological resources:

- preserving the county’s valued natural, cultural, and scenic resources;
- enhancing and restoring the natural environment and the county’s diverse landscapes.

The goals and policies of the General Plan Resources Element are intended to provide a framework for achieving the resource management vision. Goals applicable to wetland and terrestrial biological resources include:

RS.G-1: Manage and preserve the diverse land, water, and air resources of the county for the use and enrichment of the lives of present and future generations.

RS.G-2: Ensure continued presence and viability of the county’s various natural resources.

RS.G-3: Repair environmental degradation that has occurred, and seek an optimum balance between the economic and social benefits of the county's natural resources.

RS.G-4: Preserve, conserve, and enhance valuable open space lands that provide wildlife habitat; conserve natural and visual resources; convey cultural identity; and improve public safety.

Applicable policies include:
RS.P-1: Protect and enhance the county’s natural habitats and diverse plant and animal communities, particularly occurrences of special-status species, wetlands, sensitive natural communities, and habitat connections.

RS.P-2: Manage the habitat found in natural areas and ensure its ecological health and ability to sustain diverse flora and fauna.

RS.P-3: Focus conservation and protection efforts on high-priority habitat areas depicted in the Solano County General Plan (Solano County Board of Supervisors 2008, Figure RS-1).

RS.P-4: Together with property owners and federal and state agencies, identify feasible and economically viable methods of protecting and enhancing natural habitats and biological resources.

RS.P-5: Protect and enhance wildlife movement corridors to ensure the health and long-term survival of local animal and plant populations. Preserve contiguous habitat areas.

RS.P-7: Preserve and enhance the diversity of habitats in marshes to maintain these unique wildlife resources.

RS.P-8: Protect marsh waterways, managed wetlands, tidal marshes, seasonal marshes, and lowland and grasslands because they are critical habitats for marsh-related wildlife and are essential to the integrity of the marshes.

RS.P-9: Encourage restoration of historic marshes to wetland status, either as tidal marshes or managed wetlands. When managed wetlands are no longer used for waterfowl hunting, restore them as tidal marshes.

P-20: The goals, policies, and provisions of the Land Use and Resource Management Plan for the Primary Zone of the Delta are incorporated by reference. Ensure that all public and private management and development activities within the Primary Zone of the Delta are consistent with the goals, policies and provisions of the Land Use and Resource Management Plan for the Primary Zone of the Delta as adopted and as may be amended by the Delta Protection Commission.

RS.P-21: Preserve and protect the natural resources of the Delta including soils and riparian habitat. Lands managed primarily for wildlife habitat should be managed to provide inter-related habitats.

Prospect Island and the surrounding area are designated as Giant Garter Snake Priority Conservation Area and are within the Delta Primary Zone (Solano County

Board of Supervisors 2008). These designations indicate general locations of priority habitat and provide both opportunities and restrictions regarding the use of the underlying properties.

3.4.2 Significance criteria

Potential impacts to wetlands and biological resources would be significant if the Proposed Project would exceed any of the following threshold criteria per Appendix G of the *State CEQA Guidelines*:

- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW or USFWS.
- Have a substantial adverse effect on federally-protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Cause an increase in aquatic or terrestrial invasive species.
- Conflict with any local policies or ordinances protecting biological resources (Delta Reform Act-Delta Plan).
- Conflict with provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.
- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native species nursery sites.

3.4.3 Impacts and mitigation

Impact 3.4-1: Short-term impacts to perennial aquatic habitats and wetland communities from site preparation

Prior to construction, site preparation would include dewatering, clearing, and invasive plant species control. Initial site dewatering would occur over a six-week period during late summer/early fall (Table 2.2-6). Maintenance dewatering and soil drying would continue throughout the construction period. Dewatering is expected to result in temporary losses of up to 340 ac of non-tidal perennial aquatic and up to 1,100 ac of non-tidal freshwater perennial emergent wetland habitat (Table 2.2-2). Due to the planned south property levee repair along Miner Slough, the timing of dewatering may differ between the north and south properties and accordingly the duration of dewatered conditions and the temporal impacts to perennial aquatic habitats and emergent wetland communities may also differ between the north and south properties.

Following initial dewatering, up to approximately 156 ac of existing wetland vegetation would be cleared and grubbed within the construction footprint (i.e., excavated channel network, eastern toe berm and intertidal bench, site access roads/ramps, Miner Slough spur channel dredge placement area). In addition, above ground wetland vegetation would be cleared within 504 ac, including a 100-ft buffer outside of the construction footprint and all areas at moderate subtidal elevations (<0 ft NAVD 88). These cleared materials would be disked in place. To limit habitat suitability for ambush predators within the approximately 496 ac of shallow subtidal (0.0 to 2.1 ft NAVD 88) habitat, a limited number of existing trees at these elevations would be removed. All plant debris not including large wood debris retained for future use (see also Impact 3.4-13) would chipped, transported, and disked within the moderate subtidal areas (Section 2.2.3).

In addition to dewatering and clearing activities, invasive plant species control measures would be undertaken using approved aquatic herbicides applied across 504 ac of moderate subtidal areas (<0 ft NAVD 88) and within the agricultural ditches. Herbicide application for site preparation and invasive aquatic species control would occur in the late summer/early fall (Section 2.2.3).

Overall these impacts would be significant and unavoidable.

Impact significance
Significant and unavoidable

Impact 3.4-2: Short-term impacts to tidal aquatic habitats and wetland communities from dredging in the Miner Slough spur channel

Dredging is proposed to ensure that unimpeded tidal exchange occurs through the southern breach to Miner Slough spur channel. The desired increase in channel conveyance capacity would be accomplished by deepening the slough. Dredging would not result in changes in the area of tidal Waters of the U.S., including wetlands, as defined by Section 404 of the CWA within the spur channel. Further, because dredging activities would be conducted within only the navigable portions of the spur channel and no fringing tidal wetland has been documented along the rip-rapped levees of the channel, no impacts to tidal freshwater emergent wetlands would result from this activity.

Impact significance

No impact

Impact 3.4-3: Short-term loss of valley/foothill riparian habitat

Of the approximately 145 ac of existing valley/foothill riparian habitat on the Project site, clearing activities would result in short-term impacts to approximately 19 ac (Table 2.2-2). Implementation of Mitigation Measure 3.4-3.1 would largely limit riparian clearing activities to scrub shrub and understory species and would reduce this impact to less than significant.

Mitigation Measure 3.4-3.1

Potential short-term impacts to individual high value trees for nesting and roosting would be minimized during final design by avoidance and protection measures.

Impact significance

Less than significant with mitigation

Impact 3.4-4: Short-term construction-related mortality or detrimental effects to sensitive plants

Special-status plant species were not found on the interior of Prospect Island, but several occurrences have been recorded on the Miner Slough levee. Special-status plants with the potential to occur within the Prospect Island Project site are primarily limited to shallow water from 1 foot depth to perennially moist soils. Site preparation and construction activities that may affect this zone such as dewatering, clearing, grading, excavation, levee breaching, and dredging of the Miner Slough spur channel in the Proposed Project would result in the temporary loss of suitable habitat for these species. If these plants are located in the vicinity of levee breach sites or in the Miner Slough spur channel they may be directly removed either through excavation, dredging, or erosion. Drift of herbicides used invasive plant species control following site dewatering could negatively affect sensitive plant species within the Project site. This could occur via air or water and could be influenced by weather conditions and application methods. Low levels of herbicide drift may not result in direct mortality of plants, but could cause developmental and metabolic problems which could lead to increased susceptibility to disease and reduced vigor. Implementation of Mitigation Measures 3.4-4.1 and 3.2-3.2 would reduce this impact to less than significant.

Mitigation Measure 3.4-4.1

Mitigation shall include conducting pre-construction surveys for special-status plants. If special-status plants are found within the affected footprint, preservation methods such as transplantation, salvage, or seed collection and dispersal would be considered and shall be implemented if deemed necessary to avoid a significant impact to the local population through consultation with CDFW. Herbicide application practices shall include following all application recommendations for the herbicide to be applied, and refraining from applying product under wind conditions which would increase the likelihood for drift.

Impact significance

Less than significant with mitigation

Impact 3.4-5: Long-term conversion of perennial aquatic habitats and wetland communities to tidal habitat types

The Proposed Project would permanently convert up to approximately 340 ac of non-tidal perennial aquatic (open water) habitat and up to approximately 1,100 ac of non-tidal freshwater perennial emergent wetland habitat into 472 ac of perennial aquatic (open water) habitat and a total of 1,053 ac of tidal (intertidal and shallow subtidal) freshwater emergent wetland types (Table 2.2-2).

Immediately following levee breaching, approximately 1,089 ac of tidal perennial aquatic (open water) habitat and 348 ac of tidal freshwater emergent wetlands (intertidal) would be created. Within graded portions of the site, including unplanted areas of the eastern intertidal bench and toe berm, approximately 88 ac of tidal mudflat habitat would be established in the short term (Table 2.2-2). Tidal freshwater emergent wetland vegetation is expected to rapidly establish in the tidal mudflats and to expand to shallow sub-tidal elevations (0.1 to 6.5 ft [NAVD88]) within 10–15 years.

Over the long-term, increased water depths within the Project site following breaching would result in an increase of approximately 122 ac of open water (aquatic) habitat and a decrease of approximately 48 ac of wetland habitats (Table 2.2-2).

Jurisdictional Waters of the U.S.

Although increased water depths following breaching would result in an approximate long-term loss of 48 ac of federally-protected wetlands as defined by Section 404 of the CWA, the Proposed Project would result in an approximate overall increase of 73 ac of Waters of the U.S., including wetlands (DWR and CDFW 2014). Consistent with the Proposed Project objectives (Section 1.2), the resulting mosaic of tidal wetland and open water habitats would provide a number of benefits to the Delta ecosystem within the surrounding Cache Slough region, including but not limited to:

- Increased primary and secondary productivity and food availability for Delta Smelt and other native fishes (Impacts 3.3-2 and 3.3-9).
- Increased quantity and quality of salmonid rearing habitat (Impacts 3.3-2 and 3.3-9).

Overall, the Proposed Project would increase the acreage of Waters of the U.S., provide more frequent tidal inundation to adjacent natural communities, and result in a mosaic of tidal habitats that provide benefits such as resiliency to flooding, increased habitat quality, and functionality relative to existing conditions. Therefore, the overall increase in tidal Waters of the U.S. more than offsets the loss of non-tidal perennial emergent wetland and the conversion of wetland communities at the Project site would be a less-than-significant impact.

Impact significance

Less than significant

Impact 3.4-6: Long-term loss of valley/foothill riparian habitat

Breaching of the Miner Slough levees under the Proposed Project would result in the conversion of approximately 90 acres of existing valley/foothill riparian habitat below MHHW (6.5 ft [NAVD88]) to tidal freshwater emergent wetland habitat. However, as part of Project construction, the toe berm, staging areas, and other areas at the appropriate elevation shall be planted with a riparian mix containing both canopy and understory trees and shrubs creating complex, high value riparian area (Section 2.2.3). The riparian planting would reduce the long-term loss of valley/foothill riparian habitat to approximately 28 ac (Table 2.2-2). In addition, potential long-term impacts to individual high value trees for nesting and roosting would be minimized through implementation of Mitigation Measure 3.4-3.1.

Impact significance

Less than significant with mitigation

Impact 3.4-7: Reduction in available habitat for special-status plant species adapted to current conditions

Breaching of the levees would increase the mean water depth within the interior of Prospect Island because high tide levels in Miner Slough exceed the current water level which exists under non-tidal conditions. Loss of shallow water habitat may reduce the amount of appropriate habitat for special-status plant species within the Project site. Breaching the levee and opening the interior of the island to water from Miner Slough may provide a benefit to special-status plant species which currently exist in Miner Slough and surrounding waterways if hydrologic connectivity allows propagules to reach suitable habitat in the interior of the island. In addition to the construction of an intertidal bench and interior topographic features using materials excavated from the existing agricultural ditches (Section 2 Project Description), increased suitable shallow intertidal habitat for special status plant species is expected to be created at higher elevations following breaching.

Impact significance
Less than significant

Impact 3.4-8: Short-term construction-related impacts to valley elderberry longhorn beetle

Recent protocol level surveys identified seven elderberry shrubs on the Project site that were of sufficient size to provide habitat for the beetle. No indicators of extant presence (recently created exit holes) were detected. Argentine ants, known to prey upon beetle larvae, were observed on several of the shrubs. Site preparation and construction activities under the Proposed Project would not require the removal of elderberry shrubs and would take place in areas where no elderberry shrubs are present. Lastly, with respect to herbicide application for invasive plant species control, implementation of mitigation measures 3.2-3.1 and 3.2-3.2 would reduce potential short-term construction-related impacts of the Proposed Project on valley elderberry longhorn beetle to less than significant.

Impact significance
Less than significant with mitigation

Impact 3.4-9: Long-term impacts to valley elderberry longhorn beetle

The Proposed Project would not require the removal of any elderberry shrubs, and there is no evidence of recent beetle use of the shrubs at the Project site. In the long term, the Proposed Project could provide a net gain of potential habitat for the species if elderberry is included in the native riparian species mix or if natural colonization is allowed to occur. However, since there is no evidence of beetle presence at the Project site, overall there would be no long-term impact on habitat for this species.

Impact significance

No impact

Impact 3.4-10: Short-term construction-related injury or mortality and loss of habitat for giant garter snakes

Despite the lack of evidence of giant garter snake presence at the Project site (Section 3.4.1 Wetland and Terrestrial Biological Resources – Setting), potential short-term impacts to this species include construction-related direct injury or mortality as well as a temporary loss of habitat. The following site preparation and construction activities have the potential to cause injury or mortality to individual giant garter snakes:

- Clearing and grubbing
- Creation of temporary ramps and roads
- Creation of temporary staging areas
- Herbicide and mechanical invasive species control
- Dead tree/snag removal
- Excavating constructed channel network
- Blocking and filling agricultural ditches
- Construct interior topographic features
- Construction of eastern toe berm
- Excavation of levee breaches

The aforementioned activities could fill or crush burrows and crevices; obstruct giant garter snake movement; decrease the prey base for foraging; and result in the direct disturbance, displacement, injury and/or mortality of individual giant garter snakes, if present. Implementation of Mitigation Measure 3.4-10.1 would reduce this impact to less than significant.

Additionally, during the two-year construction period, potentially suitable giant garter snake habitat may be impacted by the aforementioned construction activities. A temporary loss of approximately 1,100 ac of freshwater emergent wetland would be expected at the Project site during the construction period due to site preparation and construction activities (Table 2.2-2). Implementation of

Mitigation Measure 3.4-10.1 would provide individual giant garter snakes, if present, the opportunity to move out of impacted habitats, reducing the short-term impact to less than significant.

Mitigation Measure 3.4-10.1

This mitigation measure includes the following:

1. Require construction personnel to receive USFWS and CDFW-approved worker environmental awareness training to recognize giant garter snake and its habitat.
2. Install exclusion fencing around all staging areas.
3. Survey the site at least 24 hours prior to the initiation of ground-disturbing activities in suitable giant garter snake habitat. This survey shall be conducted by a USFWS and CDFW-approved biologist in suitable giant garter snake habitat. Surveys shall be repeated if a lapse in construction activity of two weeks or greater occurs. If giant garter snake is encountered during ground-disturbing activities, activities at that specific location shall cease until appropriate corrective measures, in concurrence with USFWS and CDFW coordination, have been completed or it has been determined that individual giant garter snakes would not be harmed. Sightings shall be reported to USFWS and CDFW.
4. Implement ground disturbing construction activity within giant garter snake habitat between May 1 and October 1. This is the active period for giant garter snake and direct mortality is lessened, because giant garter snakes are expected to actively move and avoid danger. DWR would contact the USFWS and CDFW to determine if additional measures are necessary to minimize and avoid take for work between October 2 and April 30.
5. Vehicle speeds shall not exceed 15 MPH to avoid hitting giant garter snakes and other special-status wildlife.
6. Remove temporary fill and construction debris after construction completion, and, wherever feasible, restore disturbed areas to pre-Project conditions.

In addition to potential mortality or injury due to mechanical disturbance during project construction, an accidental chemical and/or petroleum spill during construction could result in the mortality or injury of individual giant garter snakes and/or prey species. Injury or mortality of individual giant garter snakes as a result of an accidental spill would be significant. Implementation of Mitigation Measure 3.2-1.2 would reduce this potential impact to a less than significant level.

As required through the federal and state permitting processes, further minimization and avoidance measures shall be developed in coordination with USFWS through Section 7 of the federal ESA consultation and with CDFW through CESA for the Proposed Project.

Impact significance

Less than significant with mitigation

Impact 3.4-11: Long-term conversion of giant garter snake habitat

The Proposed Project would convert non-tidal perennial aquatic habitat and non-tidal freshwater perennial emergent wetland to tidal perennial aquatic and tidal freshwater emergent wetland habitats (Impact 3.4-5), including a network of tidal channels and interior topographic features above MHHW (Table 2.2-2) that would provide suitable habitat for giant garter snake. Although recent surveys at Prospect Island and other locations in the surrounding Cache Slough Region did not identify or capture giant garter snake, there is potential for marginal habitat at the Project site (Section 3.4.1 Wetland and Terrestrial Biological Resources – Setting). To quantify suitable habitat, the following criteria were applied from the giant garter snake species habitat suitability model (Appendix 2A in DWR et al. 2013) using associations with existing natural community types at Prospect Island.

> *Upland basking and over-wintering habitat* was considered suitable in upland areas along perimeter levees within 200 feet of perennial aquatic and/or emergent wetland habitat, excluding mapped valley/foothill riparian habitats.
>
> *Aquatic foraging habitat* was considered suitable within freshwater emergent wetland habitat and extending 20 feet into perennial aquatic habitat, excluding dense patches of *Ludwigia spp.* mapped during invasive plant surveys (SWS and WWR 2013).

Based upon the existing mapped natural community types at Prospect Island (Figure 3.4-1), the criteria above result in an estimated 53 ac of upland basking and over-wintering habitat and 941 ac of foraging habitat for giant garter snake on the Project site. However, the existing available habitat at the Project site appears to be of marginal quality due to a combination of factors. As stated previously, the Project site has a history of flooding. The levees on Prospect Island are restricted height to allow the island to flood before neighboring islands. Flooding makes the upland habitat problematic as overwintering habitat due to the possibility the levees would overtop and drown bruminating snakes (Section 3.4.1 Wetland and Terrestrial Biological Resources – Setting). In addition, there are 75–100 ac of verified *Ludwigia spp.* stands and many more acres of potential mixed stands (Figure 3.4-1) that do not provide ideal habitat for the giant garter snake. Lastly, perennial aquatic areas of the Project site are occupied by high densities of predatory fish, which could threaten giant garter snake recruitment (Section 3.4.1 Wetland and Terrestrial Biological Resources – Setting).

Based on the above criteria, it is expected that the Proposed Project would provide 1,093 ac of giant garter snake foraging habitat in the long term, resulting in a decrease of 27 ac of upland basking and over-wintering habitat and an increase of 152 ac of giant garter snake foraging habitat. Under the Proposed Project, breaching of the Miner Slough levee would restore the site hydrology to its historical pre-reclamation tidal regime.

Under the Proposed Project, large sections of upland habitat would no longer be usable after the island is breached. However, consistent with giant garter snake conservation strategy for the BDCP (Chapter 3 in DWR 2013b), the existing perimeter levees would provide relatively low disturbance, higher quality basking and overwintering habitat. In addition, due to the presence of upland habitats adjacent to the Project area, the marginal quality of the current upland habitat, and the increased value of post-construction upland habitats, the anticipated decrease in upland habitat due to the Proposed Project would be a less than significant impact.

Additionally, the Proposed Project includes linear design features that would provide suitable aquatic foraging habitat for giant garter snake, such as small back water sloughs and toe drains (Hansen 1988). This would potentially support small numbers of snakes in a Delta location where large populations of the snake are not currently found (Section 3.4.1 Wetland and Terrestrial Biological Resources – Setting). Creation of tidal freshwater emergent wetland (including intertidal bench features) and tidal perennial aquatic habitat (including tidal channels, shallow open water, and dispersed topographic mounds) as part of the Proposed Project, including linear features that are consistent with giant garter snake conservation strategy for the BDCP (Chapter 3 in DWR 2013b), would support quality forage and escape cover habitats for giant garter snake (Table 2.2-2, DWR and CDFW 2014).

Under the Proposed Project, aquatic invasive plant species would be removed during pre-construction site preparation activities (Section 2.2.3), allowing for establishment of tidal freshwater emergent wetland habitat potentially suitable for giant garter snake foraging. However, there would be potential for the continued presence of predatory fishes, particularly Striped Bass, Largemouth Bass, and other non-native fishes in the Centrarchidae (e.g., black bass, crappie, and sunfish) and Ictaluridae (i.e., catfish and bullheads) families (see also Section 3.3.4) at the restored site. While predatory fish may still be present on the Project site, they are expected to be in much lower densities as compared with existing conditions (see also Impact 3.3-9), and any associated predation pressure on juvenile giant garter snakes would also be lower as a result.

Overall, conversion of marginal non-tidal perennial aquatic habitat and non-tidal freshwater perennial emergent wetland to tidal perennial aquatic and tidal freshwater emergent wetland habitats under the Proposed Project would be offset by the creation of a mosaic of habitats, including linear features that are consistent with the giant garter snake conservation strategy in the Bay Delta Conservation Plan, and would increase the acreage and value of available aquatic foraging habitats for giant garter snake. This would be a beneficial effect.

As required through the federal and state permitting processes, further minimization and avoidance measures shall be developed in coordination with USFWS through Section 7 of the federal ESA consultation and with CDFW through CESA for the Proposed Project.

Impact significance

Less than significant

Impact 3.4-12: Short-term construction-related habitat loss and injury or mortality of individual western pond turtles

The Proposed Project would result in a temporary loss and disturbance of aquatic and upland western pond turtle habitat during dewatering, site preparation, and construction. Site preparation and construction activities have the potential to obstruct the movement; decrease prey base; and result in the direct disturbance, displacement, injury and/or mortality of western pond turtles present. During construction it is expected that approximately 1,100 ac of freshwater perennial emergent wetland and 340 ac of perennial aquatic habitats would be temporarily lost due to site dewatering activities. Implementation of Mitigation Measures 3.2-1.2 and 3.4-12.1 would reduce this potential impact to a less than significant level.

Mitigation Measure 3.4-12.1

Prior to implementing restoration activities and/or scheduled dewatering, a qualified biologist would survey areas in or adjacent to suitable western pond turtle aquatic habitat. Western pond turtles found in harm's way would be moved by a qualified biologist to a safe location outside of the work area in a manner consistent with applicable CDFW regulations.

A qualified biologist would conduct periodic monitoring of suitable western pond turtle aquatic habitat until ground-disturbing/dewatering activities have ceased in those areas.

This mitigation measure is consistent with Solano County's General Plan policies RS.P-1 through RS.P-9.

Additionally, an accidental chemical and/or petroleum spill during construction could result in the morality or injury of western pond turtles and prey species. Short-term injury or mortality of individual western pond turtles as a result of site preparation and construction activities would be significant. Implementation of Mitigation Measure 3.2-1.2 would reduce this potential impact to a less than significant level.

Impact significance

Less than significant with mitigation

Impact 3.4-13: Long-term conversion of western pond turtle habitat

The Proposed Project would, in the long term, increase aquatic habitat for the western pond turtle from the creation of tidal channels with adjacent basking habitat on exposed during the lower end of the tide cycle. Because western pond turtles are known to occur in the tidally influenced remnant channels of Miner Slough, restoring the site to full tidal would not result in a loss of aquatic habitat for the turtle. In addition to providing suitable habitat for the turtle, existing woody debris (large tree trunk/limbs and root wads) would, to the extent practicable, be relocated to the intertidal edge for turtle basking sites under the Proposed Project (Section 2.2.3). Overall, the long-term effects on western pond turtle habitat would be beneficial. This benefit is consistent with Solano County's General Plan policies RS.P-1 through RS.P-9.

Impact significance

Beneficial

Impact 3.4-14. Short-term, construction-related injury or mortality, take of nests, and loss of nesting and foraging habitat of special-status and migratory birds

The following short-term site preparation and construction activities may cause individual injury or mortality, take of nests, or loss of suitable nesting and foraging habitat for special-status and migratory birds over the two-year construction period:

- Clearing and grubbing
- Creation of temporary ramps and roads
- Creation of temporary staging areas
- Herbicide and mechanical invasive species control
- Dead tree/snag removal
- Excavating constructed channel network
- Blocking and filling agricultural ditches
- Construct interior topographic features
- Construction of eastern toe berm
- Excavation of levee breaches

Construction activity associated with the Proposed Project, including ground disturbance, vegetation removal, presence of personnel, and operation of equipment, may injure or kill individual adults or nestlings, reduce the prey base, or cause abandonment of active nests. The Proposed Project would result in the short-term loss of riparian nesting habitat for several special-status and migratory birds at the Project site. Removal of valley/foothill riparian habitat during construction of the eastern toe berm and levee breaches would result in short-term impacts to approximately 90 ac of existing valley/foothill riparian habitat that provides suitable habitat for nesting raptors and songbirds (Table 2.2-2). Athough approximately 55 ac of riparian nesting habitat would remain undisturbed within the Project site and additional habitat is available nearby, many species such as Swainson's Hawk, which are known to occur on the Project site, are territorial, and reduction in available nesting habitat may result in displacement of nesting pairs from the vicinity. Therefore, the short-term loss of 35 ac of existing valley/foothill riparian habitat would be a significant impact. However, the toe berm sections that would be impacted are located in areas that avoid the most valuable riparian habitat on the Project site. Further, implementation of mitigation measures 3.4-3.1, and 3.4-14.1 would reduce this impact to less than significant.

The Proposed Project would also impact foraging habitats of raptors and migratory birds in freshwater emergent wetland. There would be a short-term loss of approximately 1,100 ac of freshwater perennial emergent wetland (Table 2.2-2). This would also result in an overall reduction of marginal foraging habitat for Swainson's Hawks. Construction of the eastern toe berm and eastern intertidal bench, including limited revegetation in open water edge habitat (Section 2.2.3), would eventually re-establish wetland foraging habitat, but it would take several years for vegetation to become established and mature. However, because additional wetland foraging habitat is located nearby, the short-term loss of this habitat type would be less than significant.

Mitigation Measure 3.4-14.1

This mitigation measure includes the following:

1. Site preparation and construction activities should take place outside of nesting season (February 15–August 15) to avoid take via disturbance or destruction of nests or mortality of individuals. If work begins before this period and continues uninterrupted throughout the nesting season, the consistent disturbance may deter birds from nesting at the site and prevent take.
2. If work must take place during March 15 – August 15, a preconstruction survey would be conducted within 14 days prior to the initiation of construction activity by a qualified biologist to identify nesting Swainson's Hawks within ½ mile of the construction footprint. If active Swainson's Hawk nests are found, appropriate non-disturbance buffers and avoidance measures would be developed in coordination with CDFW to avoid disturbance of nesting Swainson's Hawks based on individual bird behavior and construction-related disturbance that occurs. Surveys shall be repeated if a lapse in construction of 14 days or greater occurs. Surveys would be repeated annually if work takes place during subsequent nesting seasons.
3. If work must take place during April 1–August 31, a preconstruction survey would be conducted within 14 days prior to the initiation of construction activity to identify nesting raptors within 500 feet, and other nesting birds within 100 ft of the construction footprint. Appropriate non-disturbance buffers would be established until nestlings have fledged. Surveys shall be repeated if a lapse in construction of 14 days or greater occurs during the nesting season. Surveys would be repeated annually if work takes place during subsequent nesting seasons.
4. If work must take place during March 15–August 15 and use of non-disturbance buffers is infeasible, a qualified biologist shall be on site to monitor active nests. Monitoring requirements would be established in

coordination with CDFW. Monitors would have authority to stop work if it appears that Swainson's Hawk nests are disturbed by construction activity, and CDFW would be contacted for further guidance.

5. Remove or trim the minimal number of trees to satisfy the Proposed Project design. Trimming and removal would take place August 15 to February 15, outside of nesting season.
6. If construction activity results in take of individual birds or their nests, appropriate mitigation would be determined in coordination with CDFW.
7. Vehicle speed limits shall not exceed 15 MPH to avoid striking birds.
8. Remove temporary fill and construction debris after construction completion, and, wherever feasible, restore disturbed areas to pre-project conditions.

Impact significance

Less than significant with mitigation

Impact 3.4-15. Long-term conversion of nesting and foraging habitat for special-status and migratory birds

The Proposed Project would result in a long-term loss of nesting and foraging habitat for several special status and migratory birds at the Project site. Following construction activities, revegetation of the eastern toe berm, staging area, and along the DWSC would offset temporary losses of riparian habitat cleared during site preparation, but it would take several years for vegetation to become established and mature. However, the toe berm has been placed in areas that will avoid the most valuable riparian habitat on the Project site (Section 2.2.3). The total long-term loss of nesting and foraging habitat would be approximately 18 ac.

The Proposed Project would result in the permanent loss of 48 ac of freshwater emergent wetland (1,053 ac of intertidal + shallow subtidal wetland habitat partially offsetting the loss of 1,100 ac non-tidal wetland habitat; Table 2.2-2), which provides foraging habitat for nesting raptors and nesting and foraging migratory birds. This would also result in an overall reduction of marginal foraging habitat for Swainson's Hawks. Other emergent wetland habitat exists nearby the Project site for nesting; however, many of these species are territorial and reduction in available habitat may result in the displacement of nesting special-status birds in the vicinity of the Project site. Implementation of Mitigation Measure 3.4-3.1 would reduce these impacts to less than significant.

Impact significance

Less than significant with mitigation

Impact 3.4-16 Post-construction conversion to tidal habitat suitable for foraging migratory birds

The creation of approximately 1,053 ac of intertidal and shallow subtidal freshwater emergent wetland habitat (Table 2.2-2) for foraging birds would be beneficial.

<u>Impact significance</u>
Beneficial

Impact 3.4-17 Short-term, construction-related injury or mortality and loss of roosting and foraging habitat for western red bats

Site preparation and construction activities that may cause individual injury or mortality or loss of suitable roosting and foraging habitat for western red bats over the two-year construction period include:

- Clearing and grubbing
- Creation of temporary ramps and roads
- Creation of temporary staging areas
- Herbicide and mechanical invasive species control
- Dead tree/snag removal
- Excavating constructed channel network
- Blocking and filling agricultural ditches
- Construct interior topographic features
- Construction of eastern toe berm
- Excavation of levee breaches

Construction related activities could cause individual injury or mortality or disturb roosting bats, especially during breeding season. The largest numbers of western red bats are expected to be on the Project site during the maternity season from May to August. During most of this time young are not able to fly on their own and individuals would be unable to relocate during construction. Construction activities such as vegetation management in the form of trimming, clearing, removal by mechanical or other methods (herbicides) during this period could have a significant impact on individual western red bats. Other bat species could also be impacted by these project activities, especially vegetation removal and structure removal.

The removal of valley/foothill riparian vegetation, in particular mature trees, for site preparation and construction of the eastern toe berm and levee breaches would result in the short-term loss of roosting habitat (Impact 3.4-3). Removal of valley/foothill riparian habitat during construction of the eastern toe berm and levee breaches would result in the loss of 90 ac of suitable roosting habitat for western red bat (Table 2.2-2). This would be a potentially significant impact; however, implementation of Mitigation Measures 3.4-17.1 and 3.4-3.1 would reduce potential impacts to individual bats, roosting, and foraging habitat to less than significant.

Site preparation would result in the temporary loss of approximately 1,100 ac of freshwater emergent wetland habitat (Table 2.2-2) used for bat foraging due to its high insect concentrations. This temporary loss of foraging habitat would result in a temporary change in the composition of available prey, which could negatively impact the species. However, because additional wetland foraging habitat is located nearby, the short-term loss of this habitat type would be less than significant.

Mitigation Measure 3.4-17.1

This mitigation measure includes the following:

1. Confine clearing of vegetation to only those areas necessary to facilitate construction activities and no greater.
2. A pre-construction survey shall be conducted by a qualified biologist to identify roosting western red bats during the maternity season (May through August). If roosting bats are present, construction activities that involve the removal of mature riparian trees, snags, and remnant structures suitable for roosting shall be timed to avoid bat maternity season (May through August).
3. Where ever feasible the Project design and implementation would avoid potential roosting habitat especially large mature trees like cottonwood and sycamore.
4. Coordinate with CDFW on measures to minimize impacts to individuals

Impact significance

Less than significant with mitigation

Impact 3.4-18: Long-term removal of western red bat roosting and foraging habitat

The Proposed Project would result in a long-term loss of roosting habitat for western red bats at the Project site. Following construction activities, revegetation of the eastern toe berm, staging area, and along the DWSC would offset temporary losses of riparian habitat cleared during site preparation, but it would take several years for vegetation to become established and mature. While the toe berm has been placed in areas that will avoid the most valuable riparian habitat on the Project site (Section 2.2.3), there would still be a long-term loss of approximately 28 ac of potential roosting habitat. Implementation of Mitigation Measure 3.4-3.1 would reduce these impacts to less than significant.

The Proposed Project would result in the permanent loss of 48 ac of freshwater emergent wetland (1,053 ac of intertidal + shallow subtidal wetland habitat partially offsetting the loss of 1,100 ac non-tidal wetland habitat; Table 2.2-2), which provides foraging habitat for western red bats. However, bats will also forage over open water areas replacing the emergent marsh and on the emergent marsh fringe. This would be a less than significant impact.

Impact significance

Less than significant with mitigation

3.5 Geology and Soils

This section describes geology and soil conditions in the vicinity of the Project site, and assesses the geologic and soil impacts, constraints, and hazards on the Project site. Geology and soil issues addressed herein include seismic (earthquake) hazards, slope stability, soil expansion, settlement, and erosion. This analysis is based on a review of soils and geologic studies and maps prepared by private consultants and resource agencies for the region, Project site, and adjacent development projects.

This chapter evaluates potential geologic and soils impacts, including erosion during and/or after construction resulting from proposed levee reconfiguration and breaching, slough channel excavation, or soil placement.

3.5.1 Setting

Environmental setting

Geology

The tectonic setting and geologic history of the Delta occurs within a distinctive geologic province, composed primarily of alluvial sediments that have accumulated within a marine-terrestrial depositional basin since the mid-Mesozoic era. This section builds from the broader understanding of the regional geologic setting and summarizes pertinent information on the tectonics and local surficial sediments (soils) within the Cache Slough Complex or Proposed Project region. The Project site is located along the east side of this region.

Tectonic setting

The Proposed Project region lies within the Great Valley geomorphic province—a deep, sedimentary basin principally fed by surrounding uplands of the Coast Ranges to the west and the Sierra Nevada to the east. The catchment area of the Proposed Project region, lies to its west, and includes low-order streams draining the Vaca Mountains and Montezuma Hills. These uplands compose part of the central portion of the Coast Range province—a tectonically active zone, composed primarily of right-lateral strike-slip (horizontal sliding motion) faults, separating the Pacific and North American tectonic plates. In contrast, the Great Valley province, which underlies the Proposed Project region, hosts few active faults. The Hayward Fault Zone lies about 42 mi to the southwest of the Project site. On the east side of the Central Valley, the Foothills Fault System (south central reach section [Ione fault]) lies about 40 mi to the east of the Project site. The closest fault[6] designated "active" by the California Geological Survey (CGS) is the Green Valley Fault Zone, located about 27 mi to the west-southwest of the Project site, along Sulfur Spring Mountain (Bryant and Hart 2007). Historical surface displacement (within the past 200 years) has been noted along sections of the Green Valley Fault (CGS 2010a). This fault has an estimated slip rate of about 0.1in per year over the past several decades.

The USGS estimates a 6% probability of the fault experiencing an earthquake of magnitude 6.7 or greater before the year 2030 (USGS 1999). Shaking-hazard risk within the alluvial portion of the Proposed Project region is moderate—with probabilistic peak-ground motion[7] of about 30%. This is low in comparison to the

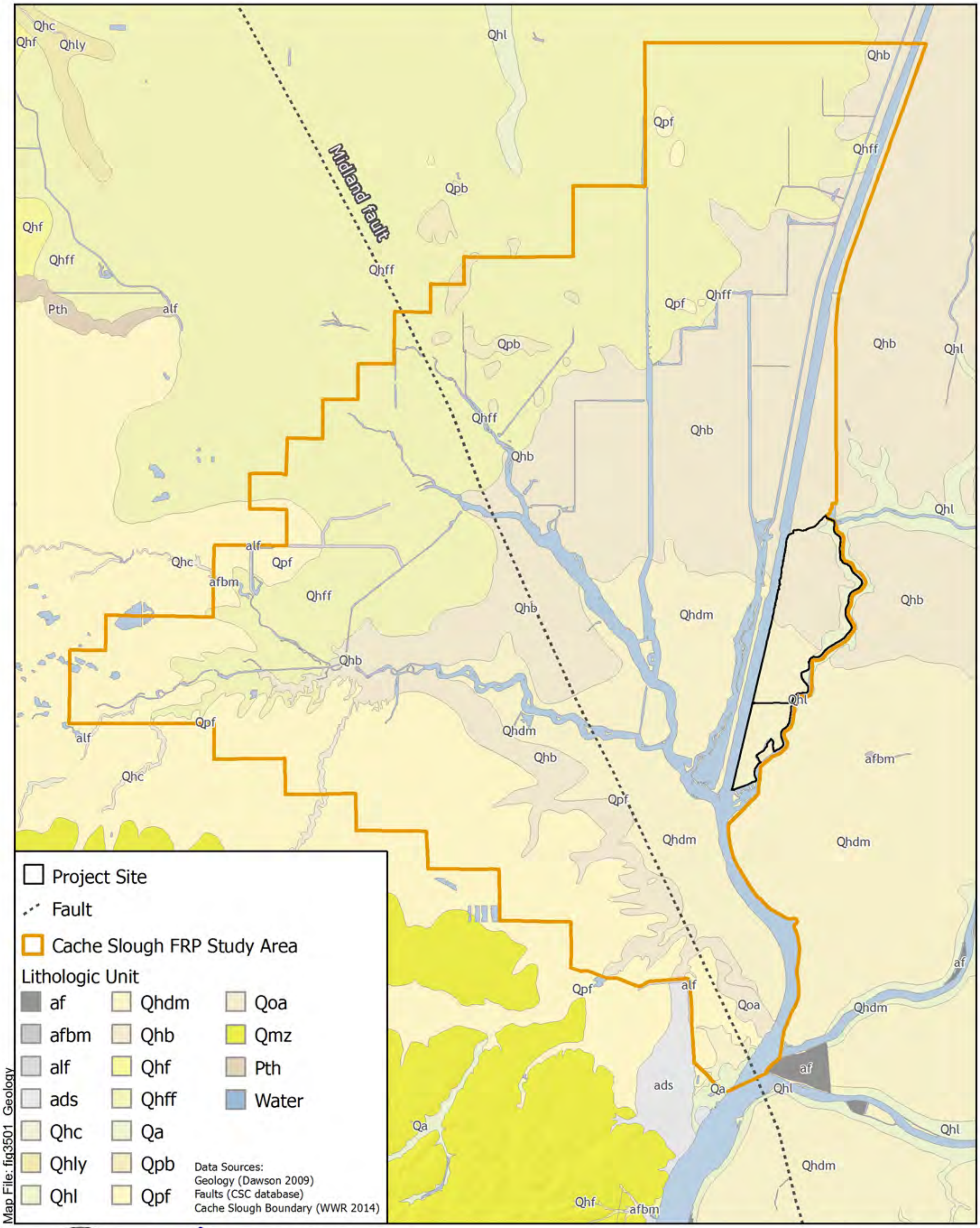
[6] An "active fault" is defined by the state as a fault having seismically induced (tectonic) surface displacement within the Holocene epoch, or the past 11,000 years (Bryant and Hart 2007).
[7] Peak ground motion (10% probability of being exceeded in 50 years) is expressed as a percent of the acceleration due to gravity (CGS 2013).

higher shaking-hazard level predicted for much of the Coast Range (30–80%), but not as low as that predicted for the middle of the Central Valley (less than 2%)(CGS 2013).

There are other potentially active faults[8] located closer to the Project site (Figure 3.5-1). Approximately 14 miles west-southwest of the Project site lie a series of parallel, smaller faults, called the Vaca-Kirby Hills faults, with Late Quaternary activity (i.e., last movement estimated within the past 700,000 years) (CGS 2010a). These faults run along the Vaca Mountains and Montezuma Hills within the headwaters of the Cache Slough drainage The Midland Fault Zone located about two (2) miles west of the Project site, bisects the Proposed Project region with a roughly north-south trace closely aligned with the Cache Slough channel. This fault is considered “potentially active” since past displacement is estimated sometime during the Quaternary period (last movement estimated within the past 1.6 million years)(CGS 2010a).

While the Delta is not directly affected by ground-rupture hazards, the Delta islands are susceptible to liquefaction due to shallow groundwater depths and presence of sandy-peaty soils having low cohesive strength (Mount and Twiss 2005). These lands also are susceptible to levee damage caused by seismically induced failure (i.e., mass-failure, liquefaction) or focused wave-energy (i.e., seiches) in the Delta channels (Mount and Twiss 2005, Betchart 2008). Overall, however, the Proposed Project region is estimated to have a low susceptibility to earthquake-induced levee failure, compared with the rest of the Delta (Torres et al. 2000). As described in the Soils section below, the soils of the Proposed Project region are more mineral in nature, than those of the Central Delta, and thus generally have lower liquefaction potential.

[8] A “potentially active fault” is defined by the state as a fault having surface displacement within the Pleistocene epoch (Bryant and Hart 2007), or between 11,000 years and 2.6 million years before present. The beginning of the Pleistocene epoch (and Quaternary period) was officially changed in 2009 from 1.6 to 2.6 million years before present (Walker and Geissman 2009). The CGS’s Special Publications 42 (Bryant and Hart 2007) from which the definitions of “active faults” and “potentially active faults” originate predates this amendment and, therefore, defines the Pleistocene epoch as occurring between 11,000 years and 1.6 million years before present.



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0 1 2 Mi

0 2 4 Km

Figure 3.5-1

Geology of the Project Region and Site

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Surficial geology

The valley floor of the Great Valley geomorphic province is composed of unconsolidated to semi-consolidated, continental alluvium that has deposited continuously during the Quaternary Period (last 2.6 million years) (Wagner et al. 1981, Graymer et al. 2006, Dawson 2009, CGS 2010b) (Figure 3.5-1). The vast majority of these sediments were delivered from alluvial processes of the Sacramento River and its major tributaries flowing from the Sierra-Nevada and Coast Ranges. Draining the leeward side of the central Coast Ranges, the upper Cache Slough catchment is underlain by old, marine sedimentary rocks of late Mesozoic and early Tertiary age that compose part of the Great Valley Complex and, together, underlie the younger surficial sediments found in the Delta. These older rock units include mostly well consolidated, inter-mixed sandstones, shales, and conglomerates (and some volcaniclastics) which formed within an ocean (forearc) basin that once lay west of the Mesozoic North American margin, at the edge of the Sierra Nevada (Harden 2004).

The shallow sediments (and soils) found within the Proposed Project region reflect the pre-settlement morphodynamics of this region, when alluvial sediment was regularly deposited within submerged areas of the southern Yolo Basin and tidal marshlands and sloughs of the Delta. The Proposed Project region is underlain primarily by four distinct alluvial units, laterally encircling the Delta as a product of the interplay between fluvial and tidal forces over the past 100,000 years. The units described below follow the naming convention presented by the CGS (Dawson 2009), and are further described with similarly mapped units published by Helley et al. (1979), Atwater (1982), Wagner et al. (1981), and Graymer et al. (2006) (Figure 3.5-1).

- ***Qhdm*** (southeast side, majority of Delta; similar to *Qi* of Wagner et al. [1981]): Intertidal sediments (peaty mud) of late Holocene age deposited at or near sea level in tidal marshes of the Delta (this unit underlies approximately the southern half of the Project site).
- ***Qhb*** (central area, extending away from the Delta; similar to *Qb* of Wagner et al. [1981]): Fine-grained alluvial flood-basin deposits of late Holocene age with horizontal stratification deposited in topographic lows (this unit underlies approximately the northern half of the Project site).
- ***Qhff*** (northwestern side, extending even farther away from the Delta; similar to *Q* of Wagner et al. [1981]): Unconsolidated and semi-consolidated fine-grained, moderately- to poorly-sorted, alluvial-fan sediments of Holocene age deposited by upland streams (e.g., Putah Creek) as debris flows, hyper-

concentrated mudflows, or braided stream flows (this unit does not underlie the Project site).

- ***Qpf*** (southwest side, at base of Montezuma Hills; similar to *Qo* of Wagner et al. [1981]): Older alluvial fan deposits of late Pleistocene age derived from Montezuma Hills composed of moderately- to poorly-sorted and bedded sand, gravel, silt, and clay sediments (this unit does not underlie the Project site).

It should be noted that a narrow band of unit ***Qhl*** (Holocene fan levee deposits) is present along most of the eastern portion of the Project site. This unit is related to flood levee deposition from Miner Slough.

Formation of surficial materials in the pre-settlement tidal marshlands of the Delta was driven by deposition of inorganic sediment from the Sacramento and San Joaquin rivers, and by *in situ* accumulation of organic matter (Atwater 1982), with the relative contributions of each process varying through time (Drexler 2011). Peat formation occurred until land reclamation began in the late 1800s, during Euro-American settlement (Mount and Twiss 2005, Whipple et al. 2012). Reclamation, consisting of levee construction around the Delta islands to facilitate agricultural practices, disconnected these lands from the tidal and fluvial flooding that once supported tidal marsh. Resultant oxidation of the drying peat soils has led to soil depletion and subsidence of the diked Delta islands, including those in the Proposed Project region however, subsidence has occurred at lower magnitudes in the Proposed Project region due to thinner peat deposits at the Delta basin edges (Mount and Twiss 2005).

Soils

This section provides a description of the soils units and hydrologic soils groups in the Proposed Project region, followed by a brief discussion of the potential for seepage following restoration.

Mapped soils units

Soils mapped by the Natural Resources Conservation Service (NRCS) in the Proposed Project region reflect the depositional pattern of surface sediments and *in situ* formation of soil materials (NCSS 2012). There are over 34 distinct natural soil units, composing four soil groups: Sacramento-Ryde-Egbert; Stockton-Clear Lake-Capay; Willows-Solano-Pescadero; and San Ysidro-Antioch (Figure 3.5-2). These groups generally coincide with the four mapped surficial geologic units of Wagner et al. (1981) and Dawson (2009). In general, the soils in the Proposed Project region are poorly drained, silty-clayey loams with mostly non-saline to slightly saline conditions. The slightly to moderately saline soils, accounting for approximately 20% of the diked and tidal lands in the Proposed Project region, have the potential to be detrimental to plant growth for species sensitive to saline conditions. There are also rare occurrences of sandy-gravelly soils with high infiltration potential. The silty-clayey soils have a relatively high potential for shrink-swell behavior, a primary characteristic of expansive soils[9] common to the Delta. This condition generally limits construction of structures without importation of artificial fill or implementation of other significant engineering solutions. Artificial fill is also present in the area, primarily as the dominant material used to construct the levees of the DWSC.

Sacramento-Ryde-Egbert soil group

This soil group is situated along the eastern half of the Proposed Project region, and generally coincides with the submerged lands and the geological units *Qhdm* and Qhb (Figure 3.5-1). This soil group underlies the majority of the Project site (Figure 3.5-2). The 15 distinct soil units that comprise this group are mostly silty clay loams, having high run-off potential, moderately low infiltration rates, non-saline conditions, and moderate to high shrink-swell potential. Two sandy units are present (Columbia fine sandy loam and Tujunga fine sand), which have high infiltration rates and low shrink-swell potential as a function of their larger particle sizes. These units are situated along the east and south sides of the Project site, respectively, the latter of which is perennially submerged.

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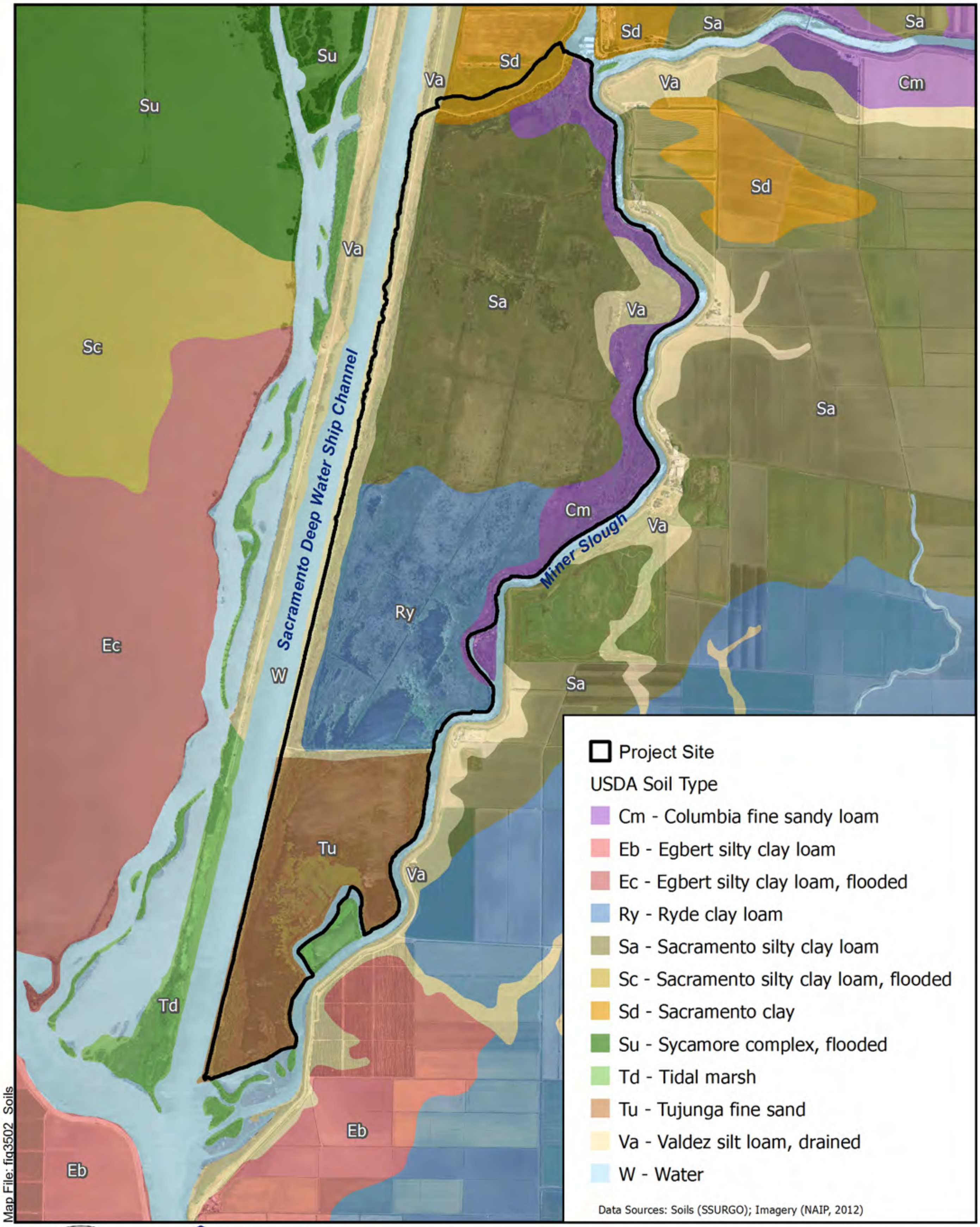
[9] Expansive soils are characterized by the ability to undergo significant volume change as a result of varying soil-moisture content. The 2010 California Building Code, Title 24, Part 2, Section 1803.5.3: Geotechnical Investigations defines an expansive soil as meeting the following provisions: (1) plasticity index of $\geq$15; (2) >10% soil particles pass a No. 200 sieve (0.075 mm); (3) >10% soil particles are <0.005 mm; and (4) expansion index of >20.



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0 0.25 0.5 Mi

0 0.5 1 Km

Figure 3.5-2

Soil Units Underlying the Project Site

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Soil seepage potential with restoration

In addition to classifying soil units by series, as described above, the NRCS also classifies soil units within defined hydrologic soils groups, based upon their run-off characteristics. These groupings are based on the following factors:

- intake and transmission of water under the conditions of maximum yearly wetness (thoroughly saturated)
- soil not frozen
- bare soil surface
- maximum swelling of expansive clays

Hydrologic soil group classification for a given soil unit is determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity (Ksat) and depth to any layer that is more or less water impermeable (such as a fragipan or duripan) or depth to a water table (if present) (NRCS 2007).

Soil units within in the Proposed Project region fall primarily within two hydrologic soil groups (Figure 3.5-3):

- Group C soils are generally composed of 20 to 40% clays with less than 50% sands or gravels. These soils have "moderately high run-off potential", Ksat = 1.42 inches (in) per hour
- Group D soils are generally composed of greater than 40% clays and less than 50% sands or gravels, and exhibit "high run-off potential", Ksat $\leq$.14 in per hour

One exception to this is an area of soils in the southern portion of the Project site, which falls into hydrologic group A, with low saturated run-off potential, and a very small area along the western boundary of the Proposed Project region, with soils grouped into hydrologic soils group B, with moderate saturated run-off potential (3). Where soils have low run-off characteristics (i.e., high infiltration rates, even under saturated conditions), there may be potential for groundwater seepage into adjacent diked lands.

The data presented in Figure 3.5-3 indicate that much of the eastern extent of the Proposed Project region (including the Project site) is composed of soil units that generally have low permeability and can, therefore, support restoration projects that should not be significantly affected by potential seepage impacts to surrounding areas. Further evaluation of the hydrogeology of the Project site and seepage potential from the Project site to surrounding areas is covered in Section 3.1 Hydrology.

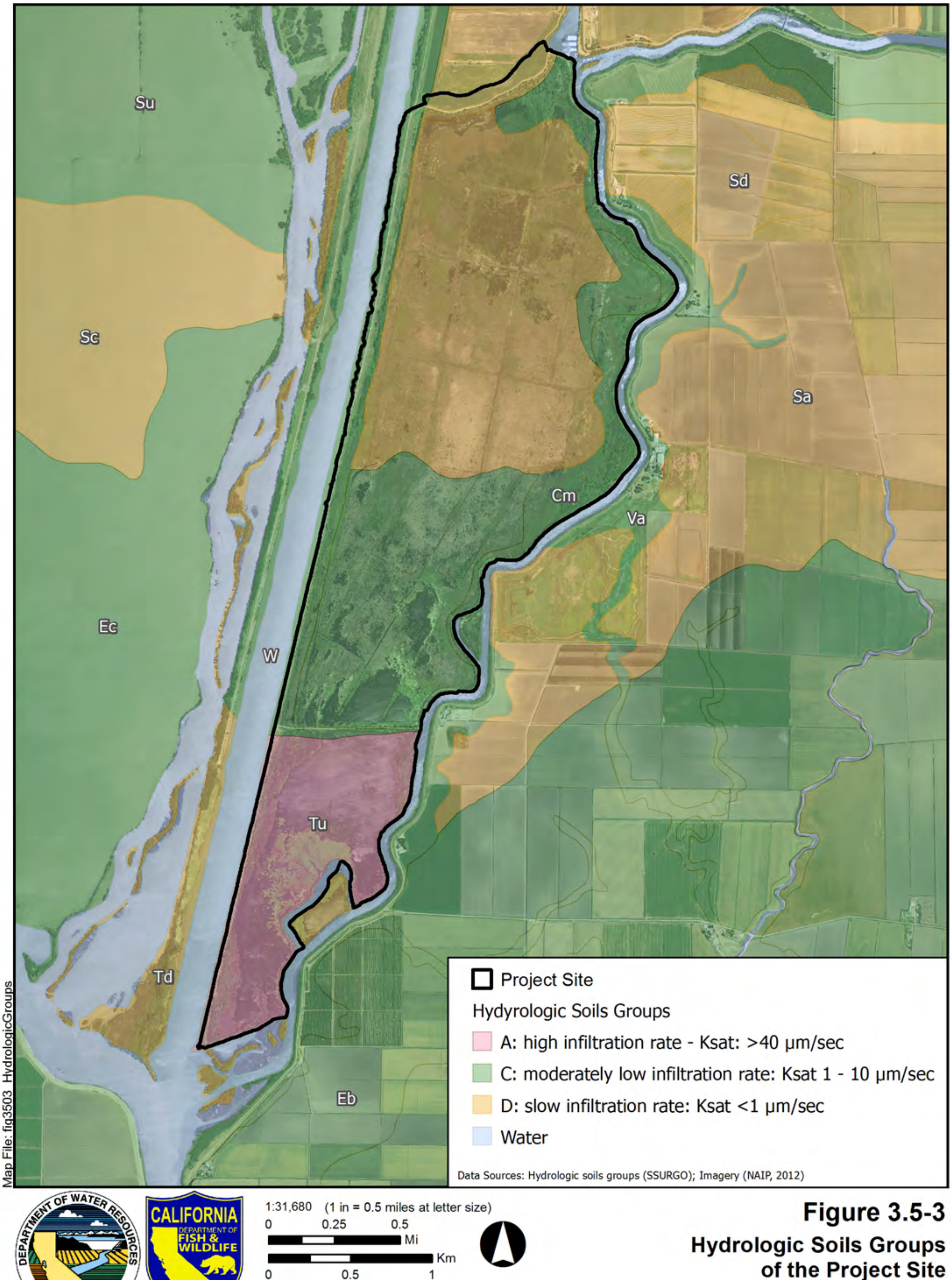


Figure 3.5-3

Hydrologic Soils Groups of the Project Site

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Subsidence in the Proposed Project area

Subsidence, triggered by the oxidation of soil organic matter, has been expressed dramatically throughout the Delta since reclamation activities began in the 1800s (Figure 3.5-4) (Deverel and Leighton 2010). Soil type and organic matter content are key factors that determine rates of subsidence. Within the Proposed Project region, mineral surface soils (0 to 10% organic content) generally predominate, whereas in the central, eastern, and southern Delta, the majority of the area is composed of highly organic surface soils (>10% organic content); as would be predicted, these regions have experienced the greatest subsidence rates (Figure 3.5-5) (Deverel and Leighton 2010). Between zero and 10 ft of subsidence has been documented within the Proposed Project region as compared to more than 15 ft in the heart of the central Delta, along the San Joaquin River (Figure 3.5-4). Subsidence within the Proposed Project region has generally been localized in the south-eastern portion, where the soils contain the highest organic content (5 to 10%) (Figure 3.5-5). Based on future subsidence rates estimated by Deverel and Leighton (2010), these areas are projected to subside up to 1.6 ft more by the year 2050.

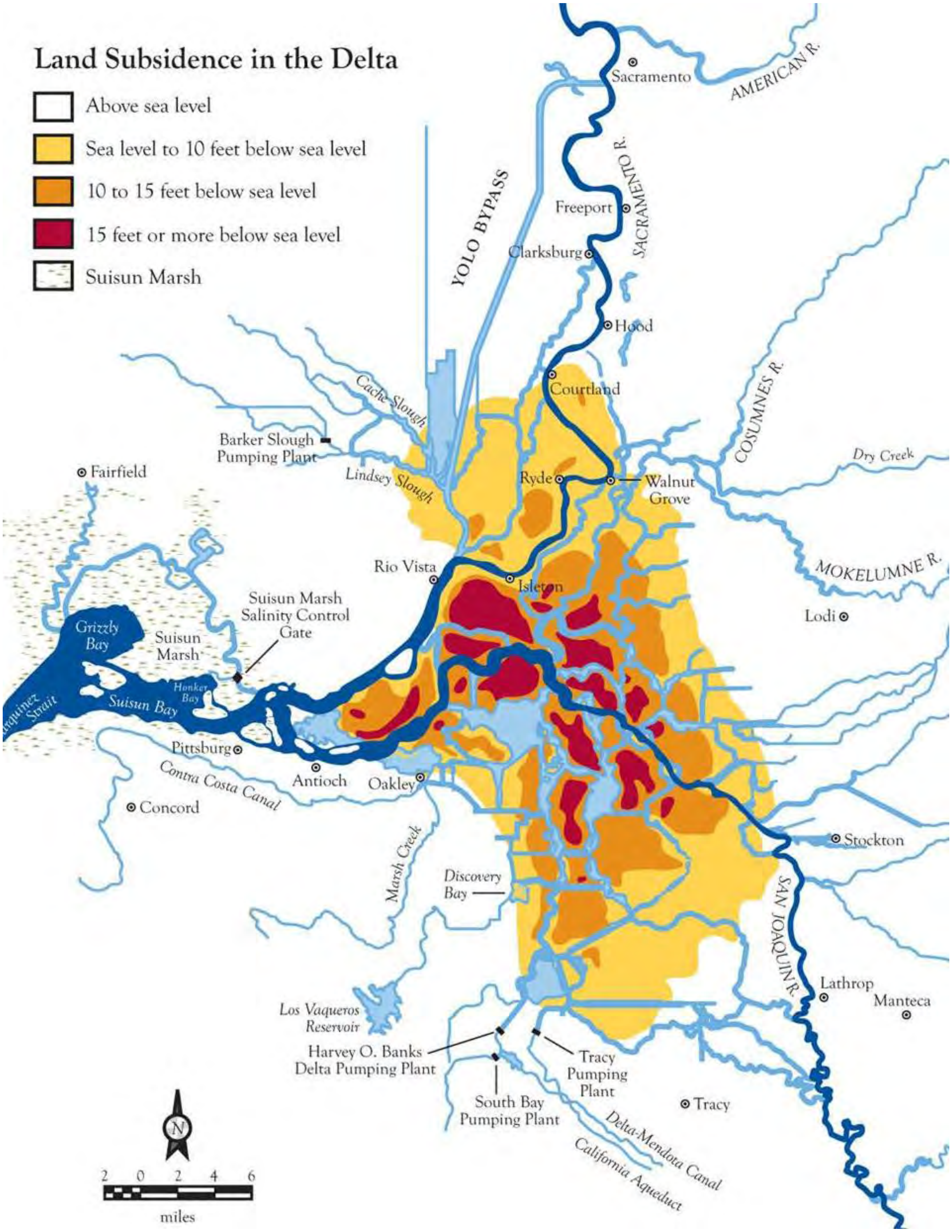


Figure 3.5-4
Land Subsidence throughout the Delta

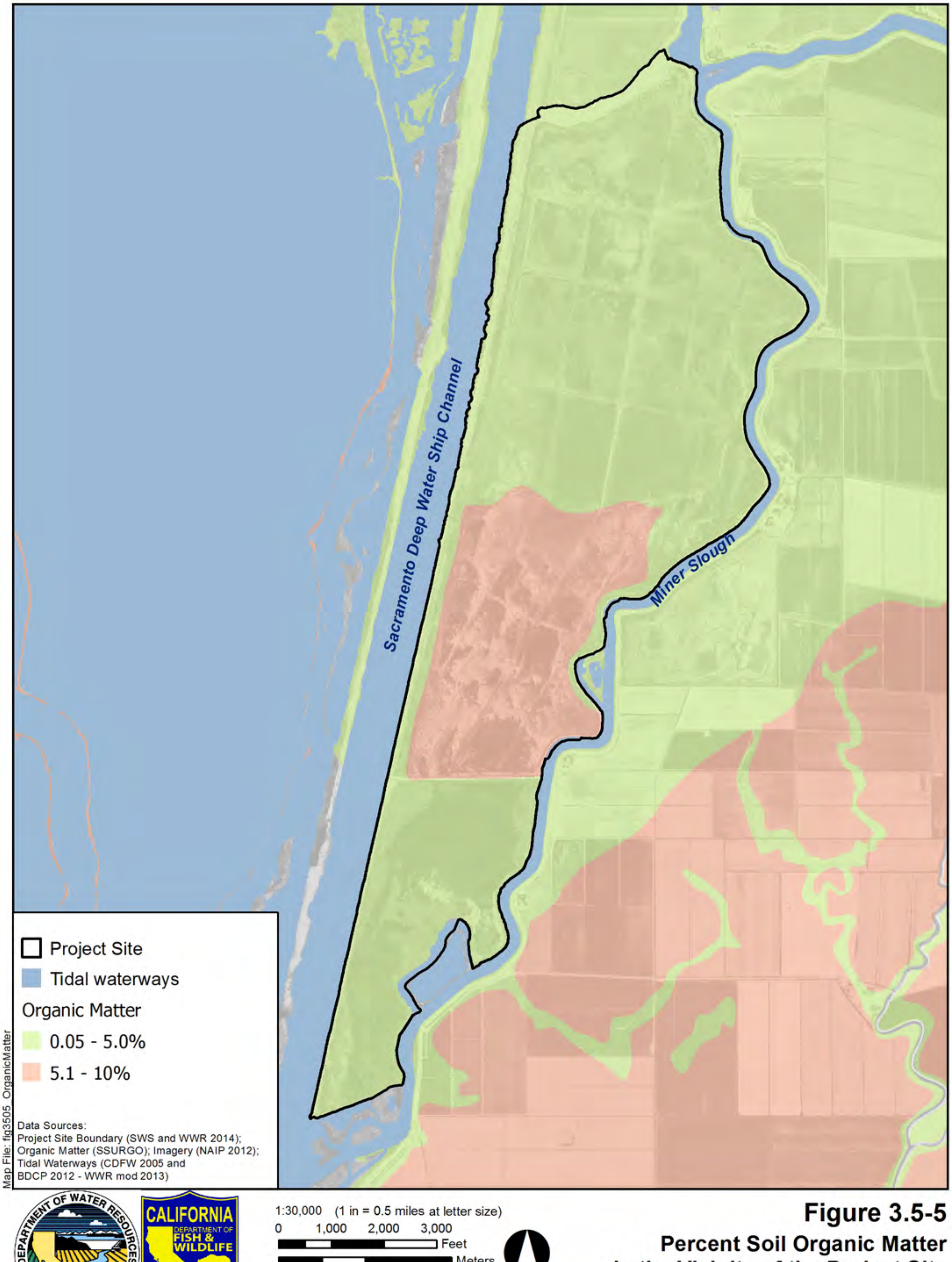


Figure 3.5-5
Percent Soil Organic Matter in the Vicinity of the Project Site

Legal and regulatory setting

State and local laws and regulations that guide building and construction activities include several acts and plans specifically regulating these activities in geologic hazard areas. In the seismically active San Francisco-Bay Delta estuary, these laws and regulations are particularly relevant and applicable. The following section provides an overview of the principal laws and regulations.

State laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

Delta Plan

The Delta Reform Act requires that the Delta Plan promote effective emergency response and emergency preparedness and promote appropriate land use to attempt to reduce risks to people, property, and state interest in the Delta (Water Code Section 85305). The Delta Reform Act requires the Delta Plan to recommend priorities for state investments in Delta levees. In response, the Delta Plan has adopted policy RR P1, *Prioritization of Statement Investments in Delta Levees and Risk Reduction*.

The hope is that implementation of Policy RR P1 would provide adequate protection to freshwater aqueducts passing through the Delta and the primary freshwater channel pathways through the Delta against floods and other risks of failures as well as prevent water deliveries to East Bay Municipal Utilities District, Contra Costa Water District, the CVP and the SWP from being interrupted by floods or earthquakes.

Assembly Bill 1200 (Chapter 573, Statutes of 2005)

Assembly Bill 1200 directed DWR and CDFW to prepare a report on evaluating the potential effects on water supplies derived from the Delta from a variety of stressors, including continuous land subsidence, earthquakes, floods, and climate change. The bill also requires the studies of possible improvements and options (ranking of possible options) for the water-related issues in the next 50, 100, and 200 years when determining effects on the Delta.

In response to the bill, DWR and CDFW issued a report, Risks and Options to Reduce Risks to Fishery and Water Supply Uses of the Sacramento/San Joaquin Delta (DWR and CDFG 2008). This report summarizes the potential risks to water supplies in the Sacramento and San Joaquin Delta attributable to future subsidence, earthquakes, floods and climate change, and identifies improvements to reduce the effects and options to deliver water.

CALFED Delta Risk Management Strategy

A major need for the state is to determine how to make the Delta sustainable in the future. The 2000 CALFED Record of Decision presented its Preferred Program Alternative that described actions, studies, and conditional decisions to help fix the Delta. Included in the Preferred Program Alternative for Stage 1 implementation was the completion of a Delta Risk Management Strategy (DRMS) that would look at sustainability of the Delta, and that would assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences, and develop recommendations to manage the risk. To implement the Delta risk assessment, legislation requires DWR to evaluate the potential impacts on water supplies derived from the Delta based on 50-, 100-, and 200-year projections for each of the following possible impacts: subsidence, earthquakes, floods, climate change and sea level rise, or a combination of the above. The DRMS work would provide the majority of this required information. The report to the legislature was submitted in July 2008.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act intends to minimize the hazards posed to people and property during and immediately following earthquakes. First enacted in 1972 (subsequently amended), the Act prohibits the location of developments and structures for human occupancy across the trace of active faults and regulates construction activities in the corridors of earthquake faults zones. The Act prohibits and restricts construction activities and zoning classifications based upon fault activity and fault definition, providing legal definitions for active, sufficiently active, and well-defined and establishes a process for reviewing construction proposals in the vicinity of earthquake fault zones. Trained geologists conduct site-specific investigations to determine the appropriate zoning classification. Regulations are more stringent for areas of greater hazard potential. The Act identifies Earthquake Special Study Zones. The Project site is not located in a Special Study Zone.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act also intends to provide for a statewide seismic hazard mapping and technical advisory program to assist cities and counties in protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes. Under the Act, the state is responsible for identifying and mapping seismic hazard zones. Cities and counties are required to utilize these hazard maps in issuing building permits, which provides a mechanism to regulate construction and development accordingly in these zones to ensure that building standards provide for safe development. Prior to issuing permits, the Act requires site-specific geotechnical investigations be conducted and development plans incorporate measures to mitigate potential damage in most developments designed for human occupancy within the Zones of Required Investigation.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Construction and development is also subject to local permitting requirements and site-specific geotechnical investigations. This permitting process may differ somewhat by jurisdiction, but generally involves a multi-stage permit review process. Site-specific geotechnical investigations examine geology, soils, land use history, and relevant factors to ensure building standards provide for safe development.

The State Reclamation Board cooperates with federal and state agencies and local governments in establishing, planning, constructing, operating, and maintaining flood control works. Reclamation District 1667 is the entity responsible for flood protection and drainage on Prospect Island. Reclamation District 501 is the agency responsible for flood protection and drainage on Ryer Island immediately east of the Project site. The Reclamation District issues permits for projects that:

- Are within federal flood control project levees and within a Board easement, or
- May have an effect on the flood control functions of project levees, or
- Are within a Board designated floodway, or
- Are within regulated Central Valley streams listed in Table 8.1 in Title 23 of the California Code of Regulations

3.5.2 Significance criteria

Relevant criteria for determining significant impacts are based upon the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that the Proposed Project would have a significant impact on geology and soils if it would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - o Rupture of a known earthquake fault
  - o Strong seismic ground shaking
  - o Seismic-related ground failure, including liquefaction
  - o Landslides
- Result in substantial soil erosion or the loss of topsoil
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse

An analysis of potential impacts on levee stability due to wind wave erosion and scour is addressed in Section 3.1 Hydrology (Impact 3.1-4) and is not considered further here.

3.5.3 Impacts and mitigation

Impact 3.5-1: Long-term effect on exposure of people and structures to seismic- and landslide-related hazards

The Proposed Project site does not fall within an Alquist-Priolo Earthquake Fault Zone, a Seismic Hazard Mapping Act Zone, or a Landslide Hazard Map Zone, as shown on the California Geological Survey seismic hazard online mapping system (California Department of Conservation 2014). Shaking-hazard risk within the Proposed Project area is moderate—with probabilistic peak-ground motion[10] of about 30%. This is low in comparison to the higher shaking-hazard level predicted for much of the Coast Range (30–80%), but not as low as that predicted for the middle of the Central Valley (less than 2%) (CGS 2013).

Overall, the Proposed Project area is estimated to have a low susceptibility to earthquake-induced levee failure, compared with the rest of the Delta (Torres et al. 2000). Additionally, the soils of the Proposed Project region and site are more mineral in nature than those of the Central Delta, and should have lower liquefaction potential. Therefore, there is a low likelihood of earthquake-induced levee failure due to seismic-related ground failure shaking, including liquefaction.

[10] Peak ground motion (10% probability of being exceeded in 50 years) is expressed as a percent of the acceleration due to gravity (CGS 2013).

Areas of the Miner Slough levee are in critical condition and in need of remediation to improve their integrity. Independent of the Proposed Project, and prior to any work, emergency levee repairs are planned to remediate zones of the levee that have been identified to be in the most critical condition. Following these emergency repairs, the integrity of the Miner Slough levees would be increased significantly. The Proposed Project itself would not adversely affect levee integrity, and further, inclusion of the levee toe berm in the Proposed Project design would enhance overall levee integrity. This would be a beneficial effect.

Impact significance

Beneficial

Impact 3.5-2: Long-term effect on sediment deposition and erosion in Prospect Island

Soils on the Project site are mostly fine grained (silt and clay) with some areas of silty sand. Phase 2 modeling results included an evaluation of the potential effects of the Prospect Island Tidal Habitat Restoration Project on sediment transport and turbidity in the Proposed Project vicinity (Appendix C in WWR and SWS 2014). Model results for a three month simulation period spanning October through December 2012 (below normal water year) indicated that sediment deposition in Prospect Island increased relative to baseline conditions. Modeled deposition had a relatively small influence on erosion and deposition within Liberty Island, the DWSC, and Miner Slough. The predicted maximum sediment deposition within Prospect Island during the simulation period was on the order of 0.7 ft, with an uneven distribution of sediment deposits throughout the Project site. Maximum values occurred near the breaches and in the deeper central portion of Prospect Island.

Based on the Phase 2 modeling results, the Proposed Project would not result in substantial soil erosion; rather, it would result in overall sediment accretion at the Project site, with maximum annual amounts on the order of tens of centimeters (approximately 0.3 ft) (Appendix C in WWR and SWS 2014). While accretion would be unevenly distributed across the Project site, over time it would presumably help to reverse existing subsidence, offset projected future subsidence (1.6 ft by 2050; Deverel and Leighton [2010]) and promote resiliency to projected regional mean sea level rise. This would be a beneficial effect.

Impact significance

Beneficial

3.6 Hazards and Hazardous Materials

3.6.1 Setting

This section describes the potential presence of hazards and hazardous materials in proximity to the Project site and assesses the impacts of hazardous materials associated with the Proposed Project. The hazards analysis is based on existing information and review of applicable plans and policies.

Environmental setting

Historic site uses

Agricultural crops such as corn, wheat and safflower were grown on the north property from 1963 to 1994; it is likely that insecticides, herbicides and fungicides were used at the site during that time. The north property has not been farmed since 1994 (USACE and DWR 2001). Prior to 1963, the Port of Sacramento used the south property for placement of dredge spoils. Between 1963 and 1986, the south property may have been used for agriculture. Natural gas wells were constructed on the property from 1946 through 2002. The wells have since been abandoned and sealed.

Existing site hazards and hazardous materials

Background

The lands and waters of Prospect Island may contain hazardous substances associated with past agricultural, residential, and gas-extraction uses. Petroleum products and pesticides may have been stored or released into the surrounding environment. Older gas wells and underground storage tanks may have developed leaks, contaminating local soils and groundwater.

Hazardous materials may have been incorporated into levee construction, repair, and maintenance. In addition to the soil, rock, and concrete materials typically used for bank protection, the surrounding levees may include asphalt, fiberglass, automobile bodies and tires, asbestos-containing materials, and metals. The composition of the levee materials is not known throughout the island. Potential sources of contamination of levee surfaces may include trash and debris from litter and illegal dumping, contaminant-laden sediments transported in adjacent waterways and deposited on the levees, and surficial application of herbicides commonly used for weed control along the levees.

There are 20 groundwater-monitoring wells on Prospect Island. Most of the wells are located on the crown of the levee (Figure 3.1-8).

Environmental Site Assessment

A Phase I/Phase II Environmental Site Assessment (ESA) was conducted in 2008 for the north property (USBR 2008) to identify the potential for hazardous materials at the site. A tank and metal cart were discovered near the entrance to the north property during the Phase I site reconnaissance. Since the tank appeared to be a fuel tank, a Phase II Assessment was conducted, which included collection of soil samples in the vicinity of the fuel tank and laboratory analysis for diesel, PCBs, lead, and pesticides. No concentrations were found to be above state regulatory limits. Soils were also screened for hydrocarbons in association with a rusted steel drum found next to the levee road along Miner Slough. Results were well below screening levels. Overall, the Phase I/Phase II ESA did not indicate the presence of hazardous wastes and recommended no additional studies on the north property (USBR 2008).

A Phase I Environmental Site Assessment (ESA) radial records search was conducted in 2014 for the south property (DWR 2014d) to identify the potential for hazardous materials within a mile radius of the center point of the site. The records search reviewed over 50 state, federal, local environmental data bases for recorded environmental hazards. The Phase I ESA did not identify any recorded issues of concern for the south property. Four incidents were identified in the radial record search for Prospect Island. The incidents were not located on Prospect Island, but were within the radial search parameters used; three of the incidents were minor petroleum leaks from the Highway 84 Ferry and the Cache Slough Ferry, while the fourth incident involved a boat taking on water. Further, a query of the California Department of Toxic Substances Control's (DTSC's) database for Prospect Island identified no known sites within or immediately surrounding Prospect Island that would impact the site (DTSC 2015).

An aerial photograph from June 6, 1993, shows two structures later identified as part of "the Prospect Island houses" (P-48-000417[11]) (see also Section 3.14 Land Use and Planning/Population and Housing) on the east side of the north property. During a 2014 DWR site visit, it was noted that these structures no longer exist (Google Earth 2014). Outbuildings associated with the Prospect Island houses that can also be seen in the 1993 aerial photograph include a pump platform on the south-east corner of Prospect Island; the wood of the platform appeared to consist of creosote treated logs.

[11] Structure numbers are assigned by Northwest Information Center of the California Historical Resources Information System.

Two structures appear in the 1993 aerial photograph on the east side of the south property, directly south of the Hall property. During the 2014 DWR site visit, only one of the buildings (P-48-000956[11]) remains or is visible due to the overgrown shrubbery on the levee. This structure, designated as the Parus -1H-12 house, is separated from its foundation and has partially collapsed. This structure may contain asbestos and lead base paint.

Gas wells

Based on a review of the Department of Conservation Division of Oil, Gas, and Geothermal Resources website (DOGGR 2014), there are six exploratory gas wells on the northwest side of Prospect Island (Figure 3.9-1):

- Well 09520101, Union Oil Company of California, plugged and abandoned in 1969;
- Well 09500374, Chevron USA, plugged and abandoned in 1946;
- Well 09500474, Arcady Oil Company, plugged and abandoned in 1954;
- Well 09521156 Rosetta Resources Operating LLP, plugged and abandoned in 2002;
- Well 09500473, Arcady Oil Company, plugged and abandoned in 1955;
- Well 09500103, Arcady Oil Company, plugged and abandoned in 1965

These wells have been plugged and abandoned (DOGGR 2011).

Biological vectors

Biological vectors are mosquitoes, ticks, and those wildlife species (e.g., rats and other rodents) that serve as hosts to transmitted viruses, parasites, and diseases affecting humans. In Solano County, major public health concerns include mosquito transmission of West Nile virus, encephalitis viruses, and malaria parasites. In 2013, Solano County had its first and only confirmed case of West Nile virus (Solano County 2015).

The spreading of Lyme disease by ticks and of diseases transmitted by animal-hosts, such as bubonic plague and rabies, is not considered a substantial risk to public health in the Delta (CDPH 2011) and is thus not considered further in this EIR.

Water that becomes stagnant in excess of five days can serve as a breeding ground for mosquitoes. Immature mosquitoes develop and mature in stagnant habitats. Restoration projects that remove obstacles, such as dikes or enlarge tidal connections (culverts) and create channels where water can flow, have a positive impact (Rochlin et al. 2012). The Solano County Mosquito Abatement District currently manages 10 species of mosquito (Table 3.6-1).

Depending on seasonal and environmental conditions and the particular mosquito species involved, it generally takes from 3 to 12 days for a mosquito to complete its life from developed egg to early adult stage. In general, as temperature increases, the number of days from hatching to adult emergence decreases. The potentially rapid life cycle of mosquitoes can result in rapid, eruptive mosquito populations related to relatively short-term variations in flooding and emergence, or seasonal tidal cycles.

Table 3.6-1. Solano County Mosquito Abatement District: Mosquito Breeding Habitats

California Salt Marsh Mosquito (*Ochlerotatus squamiger*)	Breeds exclusively in the salt and brackish marshes along the California coast
Cool Weather Mosquito (*Culiseta incidens*)	This species seldom breeds during the summer except in coastal areas.
Encephalitis Mosquito (*Culex tarsalis*)	Permanent water with fixed depth rarely supports abundant populations unless intermittently perturbated.
Foul Water Mosquito *(Culex stigmatosoma*)	Commonly referred to as a "foul water" mosquito because of its association with polluted water.
House Mosquito (*Culex pipiens pipiens, Culex pipiens quinquefasciatus*)	House mosquitoes are common in urban and suburban communities as well as on rural premises. Members of the complex readily breed in storm sewer catch basins, clean and polluted ground pools, ditches, animal waste lagoons, effluent from sewage treatment plants and other sites that are slightly to very eutrophic or polluted with organic wastes.
Oc. melanimon	The female Oc. melanimon deposits its eggs singly (up to 150) on damp soil or at the base of grasses that would be inundated at a later date. Suitable habitat for this species includes irrigated pastures, alfalfa fields, duck clubs and other seasonal waterfowl areas.
Pale Marsh Mosquito (*Oc. dorsalis*)	Dorsalis can produce continuous broods through the spring and summer having 8-12 generations per year.
Pasture Mosquito (*Oc. nigromaculis*)	Referred to as the "pasture mosquito" in California because of its prevalence in irrigated pastures. It is a medium sized mosquito having blackish to brown coloration. Individual mosquitoes usually have a white band near the middle of the proboscis (beak). It is also found in alfalfa, rice fields, row crops, irrigation seepage and associated drainage ditches with changing water levels. Breeding has been found from sea level to an elevation of 6,000 ft
Western Tree Hole Mosquito (*Oc. sierrensis*)	Brackish marshes during the fall and late winter months
Winter Mosquito (*Culiseta inornata*)	Larvae are found in a wide variety of aquatic habitats from fresh water to salt marshes

Although no residential or urban areas occur in the vicinity of Prospect Island, there are ranch residences nearby. Currently, no mosquito abatement or control is being undertaken on Prospect Island (C. Hagen, CDFW, pers. comm., March 2014).

Legal and regulatory setting

Numerous laws and regulations at the federal, state, and local levels regulate how hazardous materials and wastes are identified, handled, treated, transported, and disposed. The USEPA, the DTSC, and the Department of Transportation regulate how material is handled and transported.

Federal laws

The USEPA is the lead federal agency responsible for the enforcement of federal regulations associated with hazardous materials. The primary legislation governing hazardous materials are the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and Recovery Act; and the Superfund Amendments and Reauthorization Act. Unless otherwise noted, the Proposed Project would comply with the following federal laws.

Comprehensive Environmental Response, Compensation and Liability Act, as amended

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 United States Code [USC] Section 9601 et seq. 1980) provides federal funds to clean up uncontrolled or abandoned hazardous waste sites, accidents, spills, discharges, and other emergency releases of pollutants and contaminants into the environment. Through CERCLA, USEPA was given authority to seek out those parties responsible for any hazardous release and assure their cooperation in the cleanup.

Resource Conservation and Recovery Act, as amended

The Resource Conservation and Recovery Act (RCRA) (42 USC Section 6901 et seq. 1976) provides USEPA with the authority to control hazardous waste from cradle-to-grave. This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. The 1984 federal Hazardous and Solid Waste Amendments to RCRA focus on waste minimization and phasing out land disposal of hazardous waste, as well as corrective actions for releases. Other mandates of this law include increased enforcement authority for USEPA, more stringent hazardous waste management standards, and a comprehensive Underground Storage Tank program. The 1986 RCRA amendments enabled USEPA to address environmental problems from underground tanks storing petroleum and other hazardous substances. RCRA also sets forth a framework for the management of non-hazardous solid wastes. RCRA Section 3006 allows USEPA with to authorize state hazardous waste programs. Once authorized, the state program operates in lieu of the federal program, although USEPA retains enforcement authority even after a state program has been authorized.

Toxic Chemical Release Inventory (Section 313) Toxic Substances Control Act

The Toxic Substances Control Act of 1976 (TSCA) (15 USC 2601 et seq. 1976) gives the USEPA authority to establish reporting, recordkeeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. TSCA addresses the production, import, use, and disposal of specific chemicals, including polychlorinated biphenyls (PCB), asbestos, radon, and lead-based paint.

The Clean Water Act

The Clean Water Act (33 USC 1251 et seq.) establishes the institutional structure for USEPA to regulate discharges of pollutants into the waters of the United States, establish water quality standards, conduct planning studies, and provide funding for specific grant projects. The USEPA has provided most states with the authority to administer many of the provisions of the Clean Water Act. In California, the SWRCB has been designated by USEPA to develop and enforce water quality objectives and implementation plans. The SWRCB has delegated these responsibilities to nine RWQCBs throughout California, which in the vicinity of Prospect Island involves the CVRWQCB.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) (42 USC 300f et seq. 6939b; 15 USC 1261 et seq.) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. SDWA authorizes USEPA to set national health-based Maximum Contaminant Levels (MCLs) for drinking water to protect against both naturally occurring and human-made contaminants that may be found in drinking water. USEPA, state regulatory agencies, and water systems managers then work together to ensure these standards are met. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells. USEPA protects underground sources of drinking water, and many environmental regulations use the MCLs for environmental clean-up standards.

Occupational Safety and Health Act

The Occupational Safety and Health Administration (OSHA) administers the Occupational Safety and Health Act, (29 USC 15) which requires special training of handlers of hazardous materials, notification to employees who work in the vicinity of hazardous materials, and acquisition from the manufacturer of material safety data sheets (MSDS). An MSDS describes the proper use of hazardous materials and is intended to provide workers and emergency personnel with procedures for handling or working with that material. The Act also requires the training of employees to remediate any hazardous materials accidental releases.

State laws and regulations

The Porter-Cologne Water Quality Control Act of 1969, promulgated within California Water Code, authorizes the state water quality agencies to implement pertinent federal CWA programs (see Division 7 California Water Code Section 13160). In addition, Porter-Cologne also establishes separate, autonomous state water quality planning, permit, and enforcement programs that may affect the Prospect Island Project (Section 3.2.1 Water Quality – Setting). Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

California Hazardous Waste Control Law

The California Hazardous Waste Control Law (California Health and Safety Code Chapter 6.5 of Division 20) is the basic hazardous waste statute in California and is administered by DTSC. This law is similar to, but generally more stringent than, RCRA, and applies to a broader range of hazardous wastes, and requires recycling and waste reduction programs. Under this law, DTSC is authorized to administer California's hazardous waste program and implement the federal program in California. Title 22, Division 4.5 contains DTSC's hazardous waste regulations would need to be followed if the structure on the south property is demolished and disposed of off-site and during the work activities if there is an unforeseen incident with hazardous material usage during the Proposed Project.

California Department of Conservation, Division of Oil, Gas, and Geothermal Resources Construction-Site Plan Review Program

The Division of Oil, Gas, and Geothermal Resources (DOGGR) regulates drilling, operation, maintenance, and abandonment of oil, gas, and geothermal wells. Plugging and abandonment of oil and gas wells is to be done according to Title 14 CCR, Division 2, Chapter 4, Subchapter 1, Article 3, Sections 1723–1723.8. As part of DOGGR's responsibilities for implementing Section 3208.1 of the PRC, each of the six DOGGR districts have developed the Construction-Site Plan

Review Program to assist local agencies in identifying and reviewing the status of oil or gas wells near proposed development. The program is aimed at addressing potentially dangerous issues associated with development near oil or gas wells. DOGGR serves in an advisory role to make relevant information available to local agencies. As the owner of the north property, DWR is obligated to ensure the integrity of the abandoned gas wells during construction and operation of the Proposed Project.

California Occupational Safety and Health Act

The California Occupational Safety and Health Administration (Cal-OSHA) regulates worker safety similar to federal OSHA but also requires preparation of an Injury and Illness Prevention Program, an employee safety program of inspections, procedures to correct unsafe conditions, employee training, and occupational safety communication. In addition, Cal-OSHA regulations indirectly protect the general public by requiring construction managers to post warnings signs, limit public access to construction areas, and obtain permits for work considered to present significant risk of injury or to worker health, such as excavations greater than 5 ft.

Typically, applicable requirements found in CCR Titles 19 and 22 are included in construction contacts requiring contractors, among other things, to comply with the proper storage and disposal of substances such as fuel and lubricants. Compliance with applicable requirements for this portion of the law would be implemented once engineering designs are finalized.

Public Resources Code Section 3208.1

Public Resources Code Section 3208.1 authorizes the State Oil and Gas Supervisor of the DOGGR to order the re-abandonment of a previously abandoned well if construction of any structure over or in the proximity to a well could result in a hazard. Coordination with DOGGR would be initiated once engineering designs are finalized.

Fire hazard severity zones

In accordance with Public Resources Code sections 4201 to 4204 and Government Code sections 51175 to 51189, the California Department of Forestry and Fire Prevention (CAL FIRE) has mapped areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. The zones are referred to as Fire Hazard Severity Zones and represent the risks associated with wildland fires. Under CAL FIRE regulations, the Proposed Project is not within high fire hazard severity zones (CAL FIRE 2007).

Certified Unified Program agencies

The Unified Program consolidates, coordinates, and makes consistent the administrative requirements, permits, inspections, and enforcement activities of six environmental and emergency response programs. The Cal EPA and other state agencies set the standards for their programs, and local governments implement the standards. These local implementing agencies are called Certified Unified Program Agencies. For each county, the agencies regulate and oversee the following documents and activities:

- Hazardous materials business plans
- California accidental release prevention plans or federal risk management plans
- Operation of Above Ground and Underground Storage Tanks
- Universal waste and hazardous waste generators and handlers
- Uniform Fire Code implementation
- Onsite hazardous waste treatment
- Inspections, permitting, and enforcement
- Proposition 65 reporting
- Emergency response

Local ordinances

Unless otherwise noted, the Proposed Project would comply with the following local ordinances.

Solano County General Plan

The Public Health and Safety Element of the Solano County General Plan (Solano County Board of Supervisors 2008), sets forth goals and policies intended to help protect people and property from natural and human-made hazards, promote public health, and preserve air and water quality. Policies that may be applicable to the Proposed Project are as follows.

HS.P-26: Minimize the risks associated with transporting, storing, and using hazardous materials through methods that include careful land use planning and coordination with appropriate federal, state, or county agencies.

3.6.2 Significance criteria

Potential impacts from hazards and hazardous waste would be significant if the Proposed Project would exceed any of the following threshold criteria per Appendix G of the *State CEQA Guidelines*:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- Emit hazardous emissions or handle hazardous material, substances, or waste within one-quarter mile of an existing or proposed school.
- Be located on a site which is included on a list of hazardous material sites compiled pursuant to Government Code Section65962.5 and as a result, would create a significant hazard to the public or the environment.
- Be located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, which would result in a safety hazard for the public residing or working in the Proposed Project area.
- For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the Proposed Project area.
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.
- Expose people or structures to a significant risk of loss, injury or death involving wild fire, including where wildlands are adjacent to urbanized areas or where residence are intermixed with wildlands.
- Create substantial adverse physical impact associated with the provision of new or physically altered government facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable performance objectives (e.g., use of pesticides for vector control).
- Possess environmental effects that would cause substantial adverse effects on human beings, either directly or indirectly.

Fire, emergency services, and access issues are addressed in the Public Services and Traffic sections of this EIR, and are not addressed further in this section.

The Proposed Project has no components that could affect schools or be affected by airstrips, therefore those issues are not addressed further.

3.6.3 Impacts and mitigation

Impact 3.6-1: Potential effects from abandoned gas wells

Six plugged and abandoned gas wells have been identified at the Project site (Section 3.6.1 Hazards and Hazardous Materials – Setting), specifically in areas that would be converted to tidal wetlands or berm area. If an abandoned well is disturbed it could become a pathway for contaminants. During grading activities, heavy equipment could strike the surface plug and/or plate of one or more of the wells, potentially damaging the upper portion of the surface plug and allowing natural gas to be released to the land surface, or into groundwater and/or surface waters. Workers at the Project site could be exposed to hazardous conditions, including potential explosion and fire, associated with the upset of well plugs and the accidental release of natural gas.

Although possible, construction-related damage to the upper portion of a surface plug is not likely to result in the release of natural gas resources or fluids at the surface, gas reserves are typically located thousands of feet below ground (National Petroleum Council 2011). Furthermore, the placement of cement plugs in the well, overlain by mud placed in the borehole, would likely prevent the release of gas in the event that the upper portion of a surface plug was altered or damaged.

It is possible that other non-mapped natural gas wells may be encountered during Proposed Project construction, thereby posing an additional hazard during construction activities. There is also potential overlap between mapped gas well locations and the currently proposed locations of access ramps and excavated drainage ditches (DWR and CDFW 2014).

In summary, construction activities would create a potentially significant hazard to the public and/or the environment through reasonably foreseeable upset and accident conditions involving the release of natural gas from the abandoned wells. Implementation of Mitigation Measure 3.6-1.1 would reduce these potential impacts to less than significant.

Mitigation Measure 3.6-1.1

Final construction plans shall be revised to avoid existing conflicts between grading and excavation areas and well locations. Once site dewatering is complete and prior to construction work, a geophysical survey shall be conducted to confirm locations of all known abandoned gas wells (DOGGR 2014), which shall be marked and avoided during construction. Also prior to construction, DWR shall file an application under the DOGGR Well Review Program and the site would be inspected.

Impact significance

Less than significant with mitigation

Impact 3.6-2: Potential effects from contaminant migration via existing groundwater monitoring wells

Twenty groundwater monitoring wells are located along the levees surrounding the north property and along the cross levee. DWR's North Central Regional Office is, and plans to continue, using these wells to monitor groundwater conditions. The wells have the potential to be a direct conduit for vertical movement for point and non-point pollution into the groundwater if the wells are impacted during construction. Implementation of Mitigation Measure 3.6-2.1 would reduce this impact to less than significant.

Mitigation Measure 3.6-2.1

The Proposed Project design shall incorporate the groundwater monitoring well locations into the grading and access plans and design any construction at those locations to avoid adversely affecting the wells. If any of the existing groundwater wells are located at planned breach sites, they shall be properly destroyed and capped. Wells shall be avoided or properly destroyed and/or replaced as required by Section 13750 through 13755 (Article 2, Chapter 7, Division 7) of the California Water Code.

Impact significance

Less than significant with mitigation

Impact 3.6-3: Potential mobilization of contaminants from levee breaching and/or sediment dredging and re-use

Levee soils from breach areas and dredged sediments would be re-used within Prospect Island to fortify remaining levees and create the inner island channels (Section 2 Project Description). While there are no known contaminants in the soils of Prospect Island, or the levees or the dredge material within Miner Slough, there is potential for unknown contaminants to remobilize during construction activities and once tidal action is restored to the site, thereby releasing hazardous materials into the environment.

As part of the Proposed Project and prior to any substantial work, soils would be characterized at the planned levee breach locations, within the Miner Slough spur channel, as well as potential re-use sites within Prospect Island (Kinnetic 2015). As part of the Proposed Project and prior to any substantial work, planned locations for soil excavation would be sampled and tested for chemical and geotechnical properties. To determine whether excavated soils are suitable for beneficial reuse in aquatic and upland areas, chemical testing of these soils would include CAM 17 metals, percent solids, TRPH, as well as organochlorine and organophosphate pesticides. The results of the soil testing would provide the primary factors for characterization of the risk of potential releases to receiving waters according to the following three classes defined by the state:

- Hazardous waste is defined by specific criteria in Title 22 of the California CCR, according to numerical soluble threshold limit concentrations and total threshold limit concentrations.
- Designated waste is defined in the Water Code as (1) hazardous wastes that have been granted a variance from hazardous waste management requirements; or (2) nonhazardous waste consisting of or containing soluble pollutants that, under ambient conditions at the location of discharge, could be released in concentrations potentially exceeding water quality objectives or that could reasonably be expected to affect beneficial uses of waters of the state.
- Inert waste is defined in Title 27 of the CCR as not meeting any of the above categories.

On-site beneficial re-use of sediments classified as inert would result in less than significant impacts. On-site re-use of sediment classified as designated or hazardous would result in potentially significant impacts. Implementation of Mitigation Measure 3.6-3.1 would reduce this impact to less than significant.

Mitigation Measure 3.6-3.1

If soil testing identifies materials as designated or hazardous, then these materials must be removed from the Project site and properly disposed of at a permitted off-site facility. If this mitigation is triggered, additional analysis related to off-site transport and disposal of hazardous sediments may be required for other resources (e.g., air quality GHGs, traffic, noise).

Impact significance

Less than significant with mitigation

Impact 3.6-4: Hazards associated with the Prospect Island houses on the north property

Remnants of the Prospect Island houses (P-48-000417), including two houses, a bunkhouse, and at least three outbuildings (a pump house, wash/bath house, and a collapsed structure) are located on the north property (Section 3.6.1 Hazards and Hazardous Materials – Setting). Only the pump house remains today. In their current state, the buildings present a potentially significant physical safety hazard to the public if accessed. In addition, structures built prior to 1981 are presumed to contain asbestos and lead based paints (OSHA [CalOSHA] 29 CFR19261101,CalOSHA 1529), which could pose a potentially significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of these materials into the environment.

Under the Proposed Project, after site de-watering and vegetation removal have occurred, remnants of the Prospect Island houses (P-48-000417) and the associated outbuildings, including the irrigation pump, would be demolished and removed from the site. All materials would be disposed of at an appropriately permitted facility. Therefore, the Proposed Project would be beneficial compared with existing conditions.

Impact significance
Beneficial

Impact 3.6-5: Potential hazards associated with the abandoned house on the south property

An abandoned and dilapidated house (P-48-000956) is located on the south property Section 3.6.1 Hazards and Hazardous Materials – Setting). Historically, the building appears to have been on a raised foundation; however, the floor of the structure has since collapsed. Lead and asbestos may be present as part of the building materials. In its current state, the building presents a potentially significant physical safety hazard to the public if accessed. It also poses a potentially significant hazard to the public or the environment through accidental release of lead and asbestos into the environment.

Under the Proposed Project, after site de-watering and vegetation removal have occurred, structure P-48-000956 would be demolished and removed from the site. Any lead and asbestos associated with this structure would be removed and disposed of at an appropriately permitted facility. In addition, the old refrigerator located just to the south of the structure would be removed and disposed of properly. Therefore, the Proposed Project would be beneficial compared with existing conditions.

Impact significance

Beneficial

Impact 3.6-6: Potential soil or water contamination from onsite equipment storage and fueling

Heavy construction equipment (e.g., bulldozers, excavators, wheel loaders) necessary to move soil and conduct vegetation clearing at the Project site, as well as small accessory equipment (i.e., chainsaws, generators, water pumps) may need to be refueled or maintained on-site. Equipment refueling and maintenance activities could create a potentially significant hazard to the public and/or the environment due to potential fuel spills during routine transport and refueling, or maintenance of construction equipment. Implementation of Mitigation Measure 3.6-6.1 would reduce this impact to less than significant.

Mitigation Measure 3.6-6.1

DWR's standard construction contract Section 01570 requires contractors to conduct fueling and lubrication of equipment in a manner that affords maximum protection against spills and evaporation. Consistent with this standard, the contractor for the Proposed Project shall be required to prepare an environmental protection plan, which shall include spill control and contaminant prevention components. The contractor shall be required to have a spill kits on site and to clean up any spill as soon as reasonably possible.

Impact significance

Less than significant with mitigation

Impact 3.6-7: Potential effects on human health due to the short-term use of aquatic-approved herbicides prior to site construction

Herbicides sold in the United States must be registered with the federal government and in most cases also by state regulatory agencies. They are reviewed and regulated by the USEPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA 1974; 7 J.S.C. 135 et seq., Public Laws 92-516, 94-140, and 95-356) and recent amendments. Prior to herbicide application, the Project site would be dewatered to maximize herbicide effectiveness (DWR and CDFW 2014). The Proposed Project may use glyphosate, imazapyr, triclopyr, or similar herbicides. The potential application rates and health impacts of each of these are summarized below.

Glyphosate, if used, would be applied at approximately 7.5 pts/ac (Roundup Custom) for aquatic emergent plant species and 3.3 qts/ac (Roundup ProMax) for terrestrial plant species (Section 2 Project Description, Table 2.2-4). Glyphosate is classified by the USEPA as a Group E, evidence of non-carcinogenicity in humans. The USEPA does not consider glyphosate to be a human carcinogen. The median half-life in soil is between 2 and 197 days and typical field half-life is 47 days (Schuette 1998).

Imazapyr, if used, would be applied at 6 pts/ac (Habitat or Polaris) for aquatic emergent plant species. Imazapyr has a half-life of 14 to 44 days in forest litter/soil. There is no data that Imazapyr causes cancer, DNA damage, nerve damage, or birth defects. The USEPA classifies imazapyr as a Class E carcinogen (Oregon State University 2002, USEPA 2006).

Triclopyr (Garlon 4 Ultra), if used, would be applied at 8 qts/ac. There is no known data regarding the toxicity or long-term effects of triclopyr on humans. (NPIC 2002). Triclopyr exhibits a half-life of 1.1 to 90 days. Implementation of Mitigation Measure 3.6-7.1 would reduce this impact to less than significant.

Mitigation Measure 3.6-7.1

Herbicides shall be applied under the supervision of a certified pesticide applicator. Certified pesticide applicators are trained to ensure that algaecides and aquatic herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects including, effects to human health. Prior to herbicide application, all permits shall be in place, including USACE 404, RWQCB 401, the CDFW, Streambed Alteration Agreement, Agricultural Commission and the RWQCB NPDES permit, and/or any other relevant permits required by the federal, state, and local agencies.

Impact significance

Less than significant with mitigation

Impact 3.6-8: Potential effects on human health due to changes in the extent of mosquito breeding habitat

Currently, the Solano County Mosquito Abatement District does not actively manage the Project site. Table 3.6-1 identifies 10 varieties of mosquitos that are managed by Solano County Mosquito Abatement District and the habitat necessary for them to breed. Mosquitos can carry diseases such as encephalitis and West Nile virus. Impacts to human health from the Proposed Project would depend on mosquito production (i.e., frequency, type, and abundance) and potential for human exposure to mosquitoes, by either dispersal of mosquitoes from source areas or entry of source areas by humans.

Specific wetland habitat features favorable to mosquito production include:

1. Poorly drained, flat to gently sloping sheltered wetland areas with gradually fluctuating water levels, low turbulence, and rich organic matter from decomposition.
2. Areas of dense wetland vegetation with minimal access to fish predators, strong surface currents, or exposure to wind-generated waves.
3. Areas of gradual seasonal fluctuation in water levels, alternating between wetted and desiccated ground.

Conversely, wetland habitat features that are likely to inhibit mosquito production include strong daily tidal fluctuation and currents, exposure to surface turbulence (wind-waves, currents) of open water surfaces, and exposure to predators (fish, birds, bats).

Overall, the restored Project site is not expected to be a major source of mosquito production due to increased tidal flushing and circulation, greater water depths, and more favorable fish habitat relative to existing conditions. Areas of the Proposed Project differ in the extent to which they could contribute to potential increases or decreases in mosquito production relative to existing conditions. Open water areas (tidal perennial aquatic habitat) and shallow subtidal emergent wetlands (i.e., bed elevations near MLW) are unlikely to produce mosquitoes because they are too deep (i.e., greater than 2 ft). Based on this, the majority of the restored Project site (i.e., approximately 1,089 ac; see Table 2.2-2) would not be expected to support high mosquito production. Mosquito production may be supported in intertidal emergent wetland habitat under future conditions (i.e., approximately 428 ac; see Table 2.2-2); however, the area of potential suitable habitat is less than half that of existing non-tidal freshwater perennial emergent wetlands (i.e., 1,100 ac; see Table 2.2-2) present under current conditions. Constructed channels extending from the breach locations into the intertidal emergent wetlands would increase tidal flushing and exposure to fish predation under the Proposed Project, further reducing the potential for high mosquito production at the restored Project site.

No urban or major residential areas occur in the vicinity of the Proposed Project; however, a house located on a privately owned parcel adjacent to Miner Slough in the central part of the north property, and the residences on Ryer Island, which are located just over one mile to the east, would be subject to mosquitoes produced on the Project site.

Overall, the Proposed Project would likely reduce levels of mosquito production on the Project site relative to those of existing conditions, because it would replace non-tidal freshwater perennial emergent wetland habitat (with vegetation and hydrologic characteristics that can promote mosquito production) with perennial aquatic habitats and shallow subtidal emergent wetland habitat which, as described above, are far less suitable for mosquito production. Therefore, the effect on mosquito production would be beneficial.

Impact significance
Beneficial

3.7 Air Quality

This section provides an overview of the regulatory framework, existing air quality conditions at the Project site and the surrounding region, an analysis of potential impacts to air quality that would result from implementation of the Proposed Project, and mitigation measures for any potentially significant impacts.

3.7.1 Setting

Background

Air quality is measured by the level of air pollutants in the ambient air, and it is a function of both local climate/weather and local sources of air pollution. Both National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS), which define the maximum amount of a pollutant that can be present in outdoor air, have been established for several common and widespread air pollutants that can harm human health and the environment and cause property damage, including ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide(SO_2), particulate matter (i.e., particles less than 10 microns in diameter, PM_{10}, as well as particles less than 2.5 microns in diameter $PM_{2.5}$), and lead (Pb). CAAQS has also been set up for Visibility Reducing Particles, Sulfates, Hydrogen Sulfide (H_2S), and Vinyl Chloride. These standards were established to meet specific public health and welfare criteria; therefore these pollutants are called “criteria” air pollutants. The physical characteristics and health effects of some of the criteria air pollutants are summarized in Table 3.7-1 and the NAAQS and CAAQS are presented in Table 3.7-2.

Table 3.7-1. Physical Characteristics and Health Effects of Criteria Air Pollutants

Criteria Air Pollutant	Physical Characteristics/Health Effects
Ozone (O_3) Reactive Organic Gases (ROG) and Nitrogen Oxides (NO_x)	O_3 is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections. It can also cause substantial damage to vegetation and other materials. It is not emitted directly into the atmosphere, but is a secondary air pollutant produced through a complex series of photochemical reactions involving ROG and NOx. ROG and NO_x are precursor compounds for O_3 production. Concentrations tend to be higher in the late spring, summer, and fall, when the long sunny days combine with regional air subsidence inversions to create conditions conducive to the formation and accumulation of secondary photochemical compounds such as O_3.
Carbon Monoxide (CO)	CO is a non-reactive pollutant that is a product of incomplete combustion and is mostly associated with motor vehicle traffic. High CO concentrations develop primarily during winter, when periods of light winds combine with the formation of ground level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. In high concentrations, it can cause physiological and pathological changes sometimes resulting in death by interfering with oxygen transport in the blood.
Particulate Matter (PM_{10} and $PM_{2.5}$)	PM represents fractions of small particles that can be inhaled, causing adverse health effects. PM in the atmosphere results from many kinds of dust and fumes producing industrial and agricultural operations, fuel combustion, and atmospheric photochemical reactions. Some sources of PM, such as demolition and construction activities, are more local in nature, while others, such as vehicular traffic, have a more regional effect. Very small particles of certain substances (e.g., sulfates and nitrates) can cause lung damage directly or can contain adsorbed gases (e.g., chlorides or ammonium) that may be injurious to health. PM can also damage materials and reduce visibility.
Sulfur Dioxide (SO_2)	SO_2 is a combustion product of sulfur or sulfur-containing fuels such as coal. SO_2 also is a precursor to the formation of atmospheric sulfate and PM (both PM_{10} and $PM_{2.5}$) and contributes to potential atmospheric sulfuric acid formation that could precipitate downwind as acid rain.
Lead (Pb)	Pb has a range of adverse neurotoxic health effects, and was historically released into the atmosphere primarily via leaded gasoline. The phasing out of leaded gasoline in California has resulted in decreasing levels of atmospheric lead.

Source: Source: Yolo-Solano Air Quality Management District. 2007: Handbook for Assessing and Mitigating Air Quality Impacts: Appendix A.

Table 3.7-2. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]	National Standards [2]	
		Concentration [3]	Primary [3,5]	Secondary [3,6]
Ozone (O_3)	1 Hour	0.09 ppm (180 ug/m^3)	—	Same as Primary Standard
	8 Hour	0.070 ppm (137 ug/m^3)	0.075 ppm (147 ug/m^3)	
Respirable Particulate Matter (PM_{10})[8]	24 Hour	50 ug/m^3	150 ug/m^3	Same as Primary Standard
	Annual Arithmetic Mean	20 ug/m^3	—	
Fine Particulate Matter ($PM_{2.5}$)[8]	24 Hour	—	35 ug/m^3	Same as Primary Standard
	Annual Arithmetic Mean	12 ug/m^3	12.0 ug/m^3	15 ug/m^3
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	—
	8 Hour	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	—
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)	—	—
Nitrogen Dioxide (NO_2)[9]	1 Hour	0.18 ppm (339 ug/m^3)	100 ppb (188 ug/m^3)	—
	Annual Arithmetic Mean	0.030 ppm (57 ug/m^3)	0.053 ppm (100 ug/m^3)	Same as Primary Standard
Sulfur Dioxide (SO_2)[10]	1 Hour	0.25 ppm (655 ug/m3)	75 ppb (196 ug/m^3)	—
	3 Hour	—	—	0.5 ppm (1,300 ug/m3)
	24Hour	0.04 ppm (105 ug/m3)	0.14 ppm (for certain areas)[10]	—
	Annual Arithmetic Mean	—	0.030 ppm (for certain areas)[10]	—
Lead (Pb) [11,12]	30-Day Average	1.5 µg/m^3	—	—
	Calendar Quarter	—	1.5 µg/m^3 (for certain areas)[12]	Same as Primary Standard
	Rolling 3-month Average	—	0.15 µg/m^3	

Pollutant	Averaging Time	California Standards [1]	National Standards [2]	
		Concentration [3]	Primary [3,5]	Secondary [3,6]
Visibility Reducing Particles [13]	8 Hour	See footnote 13	No National Standards	
Sulfates	24Hour	25 µg/m^3		
Hydrogen Sulfide (H_2S)	1 Hour	0.03 ppm (42 µg/m^3)		
Vinyl Chloride [11]	24 Hour	0.01 ppm (26 µg/m^3)		

Source: CARB (2013)
Note: This table is a summary of NAAQS and CAAQS, with the methods and foot notes omitted. The full version can be found at: http://www.arb.ca.gov/research/aaqs/aaqs2.pdf (accessed on 4/12/2014).

Additional air pollutants are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects even at low concentrations. Those pollutants are called Hazardous Air Pollutants (HAPs) in federal regulations and Toxic Air Contaminants (TACs) in California regulations. Sources producing HAPs and TACs include industrial processes and commercial operations (such as emissions from gasoline stations and dry cleaners) as well as motor vehicle exhaust.

Legal and regulatory setting

The USEPA and the California Air Resources Board (CARB) manage air quality on the national and state levels respectively. Air quality management on the regional level is based on air basins, and an air basin is a land area with generally similar meteorological and geographic conditions and thus air pollution patterns throughout. California is divided into fifteen air basins regulated by thirty-five local air districts, determined largely by geographical and meteorological features while taking political boundaries into consideration. The Project site is located in the northeastern portion of Solano County within the Sacramento Valley Air Basin (SVAB). The Yolo-Solano Air Quality Management District (YSAQMD) manages air quality in the portion of SVAB covering all of Yolo County and the northeastern half of Solano County, including the Proposed Project area.

USEPA and CARB regulate direct emissions from motor vehicles, and YSAQMD has authority to regulate stationary, indirect and area sources of air pollution within its jurisdictional area. The air quality laws and regulations pertaining to the Proposed Project are described below.

Federal laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following federal laws and regulations.

Federal Clean Air Act

The Federal Clean Air Act (FCAA) (42 United States Code Section 7401), which was passed in 1970 and last amended in 1990, is a United States federal law designed to control air pollution on the national level. Basic elements of the Act include NAAQS and state attainment plans for criteria air pollutants, HAP standards, motor vehicle emissions standards, stationary source emissions standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

NAAQS for criteria air pollutants

As required by FCAA, USEPA established of NAAQS for six criteria air pollutants and also set deadlines for their attainment. As shown in Table 3.7-2, NAAQS include both primary and secondary standards. Primary standards set limits to protect public health, including the health of sensitive receptors such as asthmatics, children, and the elderly. Land uses (sites) where sensitive receptors are typically located include: schools, playgrounds and childcare centers; long-term health care facilities; rehabilitation centers; convalescent centers; hospitals; retirement homes; and residences. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

The USEPA classifies air basins (or portions thereof) as “attainment” or “nonattainment” for each criteria air pollutants, based on whether or not the NAAQS had been achieved. The FCAA required each state to prepare an air quality control plan referred to as the State Implementation Plan (SIP). The FCAA 1990 Amendments added requirements for states with nonattainment areas to revise their SIPs in order to incorporate additional control measures to reduce air pollution. The USEPA has responsibility to review all state SIPs to determine if they conform to the mandates of the FCAAA and will achieve air quality goals when implemented.

Hazardous air pollutants

Section 112(b) of the FCAA listed over 180 Hazardous Air Pollutants (HAPs0 that need to be controlled, and the HAP list has gone through several revisions and updates. Most HAPs originate from human-made sources, including mobile sources (e.g., cars, trucks, buses) and stationary sources (e.g., factories, refineries, power plants), as well as indoor sources (e.g., building materials and activities such as cleaning). USEPA, working with state and local governments, has reduced the release of HAPs from stationary sources by issuing rules covering over 80 categories of industrial and commercial sources ranging from chemical plants, oil refineries to dry cleaners and chromium electroplating facilities. Reduction of HAPs from motor vehicle exhaustion has been achieved by requiring the use of cleaner fuel such as reformulated gasoline and placing limits on tailpipe emissions.

State laws and regulations

California Clean Air Act (CAAQS for Criteria Air Pollutants)

The California Clean Air Act (CCAA), HSC Section42302.1, 42311, and 42352 (1988, as amended), was adopted in 1988 to establish a statewide air pollution control program. As required by CCAA, CARB has established more stringent standards for the six criteria pollutants that are covered by NAAQS, and has set standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility reducing particles pollutants.

The CARB also identifies and classifies each air basin in the state on a pollutant-by-pollutant basis and has designated areas in California as nonattainment based on violations of the CAAQS. CCAA requires all air districts in California to meet the CAAQS by the earliest practical date. Each nonattainment district is required to adopt a plan to achieve a 5-percent annual reduction, averaged over consecutive 3-year periods, in district-wide emissions of each nonattainment pollutant or its precursors. A Clean Air Plan (CAP) shows how a district would reduce emissions to achieve air quality standards.

California Toxic Air Contaminants Regulations

California state law defines TACs as air pollutants that may cause or contribute to increases in serious illness or death, or that may pose a present or potential hazard to human health. In accordance with AB 2728, all federal HAPs are TACs under California law. A total of 243 substances have been designated as TACs under California law. Diesel particulate Matter (DPM), a common air pollutant generated by diesel-powered equipment from construction projects, is one of the TACs under California law.

California regulates TACs primarily through Toxic Air Contaminant Identification and Control Act (AB1807, Tanner 1983) and the Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, Connelly 1987). AB 1807 created California's program to reduce exposure to air toxics. The Air AB 2588 supplements the AB 1807 program, by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local ordinances and policies.

Sacramento Regional Ozone Attainment Plan

The SVAB is designated by USEPA as severe nonattainment for 8-hour ozone NAAQS (both 1997 and 2008 standards). The area of nonattainment is referred to as the Sacramento Federal Non-Attainment Area for ozone, and it spans the jurisdictional areas of five air districts including the YSAQMD, the El Dorado APCD, the Feather River AQMD, the Placer County APCD, and the Sacramento Metropolitan AQMD). These air districts jointly prepared and adopted the "Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan" (Regional Ozone Plan) in 2009 and revised the plan in 2011 and 2013. This plan is the SIP for the region as required by the FCAA. The Regional Ozone Plan shows that the region is meeting requirements of the FCAAA for the 1997 8-hour ozone standard including meeting minimum emission reduction progress and reaching air quality standard not later than 2018. The plan updates the emissions inventory, provides a review of photochemical modeling results based on changes in the emissions inventories, updates the reasonable further progress and attainment demonstrations, revises adoption dates for control measures, and establishes new motor vehicle emissions budgets for transportation conformity purposes.

Yolo Solano Air Quality Management District Air Quality Management Plan

YSAQMD manages air quality in its jurisdictional area by monitoring air quality, designing programs to attain and maintain state and federal ambient air quality standards, developing and enforcing air quality rules that regulate point source, area source and certain mobile source emissions, and establishing permitting requirements for stationary sources.

The YSAQMD adopted its first air quality attainment plan (AQAP) in 1992 and has been updating the AQAP every three years. The most recent, namely the sixth, update to the YSAQMD's AQAP was adopted in 2013 and it includes

- Information about emission reductions achieved during the 2009–2011 periods,
- District emission inventory and emission forecasts,
- Air quality data and analysis of air quality trends through 2011, and
- Proposed commitments for the 2012–2014 periods.

According to the AQAP, the YSAQMD has conducted an "all feasible measure" analysis for ozone control measures as part of the federal planning process, and based on the results of the analysis, YSAQMD committed to adopting several measures to reduce ozone emissions. For the 2012–2016 period, YSAQMD schedules to adopt amendments to several district rules to achieve additional reductions in the emissions of ozone precursors.

While the YSAQMD is not required to prepare an attainment plan for PM_{10} and $PM_{2.5}$, the YSAQMD continues to work to reduce particulate emissions through rules affecting stationary sources, the construction industry, and the agricultural burning program.

Relevant YSAQMD rules include the following:

- Rule 2.3, Ringelmann Chart. Visible emissions from stationary diesel-powered equipment are not allowed to exceed 40 percent opacity for more than three minutes in any one hour.
- Rule 2.5: Nuisance. Dust emissions must be prevented from creating a nuisance to surrounding properties.
- Rule 2.11: Particulate Matter. To limit release or discharge into the atmosphere, from any source, particulate matter in excess of 0.3 grains per cubic foot of exhaust volume as calculated at standard atmospheric conditions.

Solano County General Plan (relevant air quality policies and programs)

The Solano County General Plan (Solano County Board of Supervisors 2008) contains various policies and actions that deal with air quality. Table 3.7-3 identifies the policies and programs that Solano County intends to carry out in conjunction with air quality and relevant to the Proposed Project.

Table 3.7-3. Solano County General Plan Policies Related to Air Quality

Policies and Programs	Description
Policy HS.P-43	Support land use, transportation management, infrastructure and environmental planning programs that reduce vehicle emissions and improve air quality.
Policy HS.P-44	Minimize health impacts from sources of toxic air contaminants, both stationary (e.g., refineries, manufacturing plants) as well as mobile sources (e.g., freeways, rail yards, commercial trucking operations).
Program HS.I-54	Require that when development proposals introduce new significant sources of toxic air pollutants, they prepare a health risk assessment as required under the Air Toxics “Hot Spots” Act (AB 2588, 1987) and, based on the results of the assessment, establish appropriate land use buffer zones around those areas posing substantial health risks.
Program HS.I-59	Require the implementation of best management practices to reduce air pollutant emissions associated with the construction of all development and infrastructure projects.
Program HS.I-61	Comply with the CARB and Bay Area or YSAQMD rules, regulations, and recommendations for Solano County facilities and operations. Such operations shall comply with mandated measures to reduce emissions from fuel consumption, energy consumption, surface coating operations, and solvent usage.
Program HS.I-62	Encourage coordination between the Bay Area and YSAQMDs for consistency in air quality planning efforts.
Program HS.I-63	Use the guidelines presented in the CARB’s Air Quality and Land Use Handbook: A Community Health Perspective, or the applicable AQMD guidelines and recommendations available at the time, when establishing buffers around sources of toxic air contaminants or odorous emissions.
Program HS.I-64	Assess air quality impacts using the latest version of the CEQA Guidelines and guidelines prepared by the applicable AQMD.

Physical setting

Topography, meteorology, and climate

The SVAB is bounded by the North Coast Ranges on the west and Northern Sierra Nevada Mountains on the east. The intervening terrain is relatively flat.

Hot dry summers and mild rainy winters characterize the Mediterranean climate of the SVAB. During the year the temperature may range from 20 to 115°F with summer highs usually in the 90s and winter lows occasionally below freezing. Average annual rainfall is about 20 in, and the rainy season generally occurs from November through March. The prevailing winds are moderate in strength and vary from moist clean breezes from the south to dry land flows from the north.

The mountains surrounding the SVAB create a barrier to airflow, which can trap air pollutants under certain meteorological conditions. The highest frequency of air stagnation occurs in the autumn and early winter when large high-pressure cells collect over the Sacramento Valley. The lack of surface wind during these periods and the reduced vertical flow caused by less surface heating reduces the influx of outside air and allows air pollutants to become concentrated in a stable volume of air. The surface concentrations of pollutants are highest when these conditions are combined with temperature inversions that trap pollutants near the ground.

The ozone season (May through October) in the Sacramento Valley is characterized by stagnant morning air or light winds with the delta sea breeze arriving in the afternoon out of the southwest. Usually the evening breeze transports the airborne pollutants to the north out of the Sacramento Valley. During about half of the days from July to September, however, a phenomenon called the Schultz Eddy prevents this from occurring. Instead of allowing for the prevailing wind patterns to move north carrying the pollutants out, the Schultz Eddy causes the wind pattern to circle back to the south. Essentially, this phenomenon causes the air pollutants to be blown south toward YSAQMD, exacerbating pollution levels in the area and increasing the likelihood of federal or state standards violations. The Shultz Eddy normally dissipates around noon when the delta sea breeze arrives.

Existing air quality conditions and attainment status

CARB and YSAQMD monitor air quality at several locations within their jurisdiction. The monitored pollutants include ozone, CO, PM_{10}, $PM_{2.5}$, and NO_2. Table 3.7-4 summarizes the most recent three years of available air monitoring data (2011 through 2013) published by CARB for the stations within YSAQMD. The data show a moderate number of violations related to state and federal ozone standards, state and federal PM_{10} standards, and the federal $PM_{2.5}$ standard and no other state or federal air quality standards were exceeded during the same period; therefore, the criteria pollutants of most concern in YSAQMD are ozone and PM.

Table 3.7-4. Annual Air Quality Monitoring Data

Pollutant	Standard	Site	Number of Days Standards Exceeded		
			2011	2012	2013
$PM_{2.5}$	National 24-Hour Standard	Solano County: Vallejo-304 Tuolumne Street	6.0	1.0	6.0
		Yolo County: Woodland-Gibson Road	*	0	0
PM_{10}	National 24-Hour Standard	Solano County: Vacaville-Merchant Street	0	0	0
		Yolo County: West Sacramento-15th Street	0	0	0
		Yolo County: Woodland-Gibson Road	0	0	0
	State 24-Hour Standard	Solano County: Vacaville-Merchant Street	0	0	*
		Yolo County: West Sacramento-15th Street	12.2	6.5	23.0
		Yolo County: Woodland-Gibson Road	6.1	6.1	23.3

Pollutant	Standard	Site	Number of Days Standards Exceeded		
			2011	2012	2013
Ozone (O_3)	State 1-Hour Standard	Solano County: Fairfield-Chadbourne Road	0	0	0
		Solano County: Vacaville-Ulatis Drive	0	0	0
		Solano County: Vallejo-304 Tuolumne Street	0	0	0
		Yolo County: Davis-UCD Campus	0	0	0
		Yolo County: Woodland-Gibson Road	0	1	0
	State 8-Hour Standard	Solano County: Fairfield-Chadbourne Road	3	2	1
		Solano County: Vacaville-Ulatis Drive	3	3	2
		Solano County: Vallejo-304 Tuolumne Street	0	0	0
		Yolo County: Davis-UCD Campus	2	4	0
		Yolo County: Woodland-Gibson Road	2	9	0
	National 8-Hour Standard	Solano County: Fairfield-Chadbourne Road	1	1	0
		Solano County: Vacaville-Ulatis Drive	0	1	0
		Solano County: Vallejo-304 Tuolumne Street	0	0	0
		Yolo County: Davis-UCD Campus	1	1	0
		Yolo County: Woodland-Gibson Road	0	2	0

Source: CARB (2015)
* insufficient data available.

Based on collected monitoring data, the state and federal governments designate the YSAQMD as the following attainment status for the various criteria air pollutants.

Table 3.7-5. Federal and State Attainment Status for the YSAQMD

Criteria Pollutant	Averaging Time	State Standards	National Standards
Ozone (O_3)	1 Hour	Non-attainment	N/A
	8 Hour	Non-attainment	Non-attainment
Carbon Monoxide (CO)	1 Hour	Attainment	Unclassified/Attainment
	8 Hour	Attainment	Unclassified/Attainment
Nitrogen Dioxide (NO_2)	1 Hour	Attainment	N/A
	Annual	N/A	Attainment
Sulfur Dioxide (SO_2)	1 Hour	Attainment	N/A
	24 Hour	Attainment	Attainment
	Annual	N/A	Attainment
Coarse Particulate Matter (PM_{10})	24 Hour	Non-attainment	Unclassified
	Annual average	Non-attainment	N/A
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	N/A	Partial non-attainment
	Annual average	N/A	Attainment
Sulfates	24 Hour	Attainment	N/A
Lead (Pb)	30-Day Average	Attainment	N/A
	Calendar Quarter	N/A	Attainment
Hydrogen Sulfide (H_2S)	1 Hour	Attainment	N/A
Vinyl Chloride	24 Hour	Attainment	N/A
Visibility Reducing Particles	8 Hour	Attainment	N/A

Source: YSAQMD (2014)

Existing conditions in the site vicinity

Prospect Island is a 1,600-acre property located in Solano County, in the northwestern part of the Sacramento-San Joaquin Delta. Prospect Island lies between the DWSC on the west and Miner Slough on the east. The Proposed Project would restore Prospect Island to freshwater tidal wetland and open water (sub-tidal) habitats to benefit native fish and improve aquatic ecosystem functions. Land use at the Project site and the surrounding properties are primarily open water and agriculture. Most of the construction activities would occur in a construction zone of approximately 200 ac within the Project site.

There are no existing stationary sources of air pollutants in the vicinity of the Project site. Very few sensitive receptors that may be impacted by air pollutant emissions from construction of the Project have been identified. The nearest potential residence is a house, which is located adjacent to the construction zone on a privately owned parcel and is not permanently occupied. The next most proximal residences are those on Ryer Island, which are located over one mile to the east of the Project site. No schools, hospitals, or other facilities with a large number of sensitive receptors are present in the immediate vicinity.

3.7.2 Significance criteria

Appendix G of the CEQA Guidelines, published by the state Office of Planning and Research (OPR), contains a list of effects that may be considered potentially significant:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the Proposed Project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- Expose sensitive receptors to substantial pollutant concentrations; and,
- Create objectionable odors affecting a substantial number of people.

Based on the above, the YSAQMD has developed CEQA significance thresholds for Proposed Project construction and operation to assist lead agencies in determining significant air quality impacts for their projects (see Table 3.7-6). The YSAQMD has published a Handbook that is intended to provide local governments with guidance for analyzing and mitigating project-specific air quality impacts (YSAQMD 2007). Because of the YSAQMD's regulatory role in the vicinity of the Proposed Project, the CEQA significance thresholds as well as the standards, methodologies and analysis procedures provided in the Handbook are used for the Prospect Island analysis. Cumulative impacts are discussed in Section 3.19.3 Cumulative Impacts – Summary of cumulative impacts.

Table 3.7-6. YSAQMD Thresholds of Significance

ID	Threshold	A project would be considered to have a significant air quality impact, if:
1	Criteria Pollutants	It generates criteria pollutants in excess of any of the following thresholds: 80 pounds per day of PM_{10} 10 tons per year of ROG or NOx. Violation of a state ambient air quality standard for CO
2	Plan Consistency	It is inconsistent with any applicable general plans and regional plans such as air quality attainment or maintenance plan or State Implementation Plan [SIP].
3	TACs	It exposes the public to TACs from stationary sources in excess of any of the following thresholds: Probability of contracting cancer for the Maximally Exposed Individual (MEI) equals to 10 in one million or more. Ground-level concentrations of non-carcinogenic toxic air contaminants would result in a Hazard Index equal to 1 for the MEI or greater.
4	Offensive Odors	It generates odorous emissions in such quantities that: could cause detriment, nuisance, or annoyance to any considerable; number of persons or to the public; may endanger the comfort, repose, health, or safety of any such person or the public; or may cause, or have a natural tendency to cause, injury or damage to business or property.

3.7.3 Impacts and mitigation

Impact 3.7-1: Generation of criteria pollutant emissions that could contribute to air quality violations

Air quality impacts can be divided into those related to the construction of the Proposed Project, which is short-term and temporary nature, and long-term impacts associated with operation of the Proposed Project. Each of these is discussed below.

The construction of the Proposed Project would last approximately 2.5 years from April 2018 to November 2020 (Table 2.2-6). Initial site preparation following dewatering would require aquatic invasive species control in an area of 411 acres using aerial spraying of herbicide by helicopter. Clearing and grubbing would occur across 156 acres (Table 2.2-3). An additional 504 acres would be cleared, generating a total of up to 29,000 cubic yards of organic material that would be chipped and disked on site (Table 2.2-3). Site preparation would also involve the repair of the south property Miner Slough levee and demolition of existing structures.

Project construction would involve excavation of the channel network, dredging of Miner Slough spur channel, construction of the levee toe berm and the intertidal bench, interior topographic features, and construction of levee breaches. Approximately 59,160 cubic yards of fill material, 34,000 cubic yards of aggregate base, 1,640 tons of rip-rap (stone armoring and rock slope protection) would be imported from off-site locations for the construction of access road, ramps and interior staging area. Over 500,000 cubic yards of soil would be excavated and re-used on site.

During the construction period, diesel-powered off-road heavy construction vehicles, such as excavators, dozers, loaders, graders, and scrapers would be used for activities such as clearing and grubbing, clearing channels and ditches, excavation and transportation of soil, compacting and grading. Some other types of equipment, such as the pumps for dewatering of the properties, dredgers and the tugs/barges performing work in the water, and aircraft for spraying herbicide, would also be powered by diesel engines. Construction of the Project would also involve the use of on-road vehicles, such as trucks for material delivery, passenger cars, and trucks for worker commuting; these vehicles would use either diesel or gas as fuel. Diesel-powered or gas-powered off-road construction vehicles as well as on-road vehicles and other equipment would be substantial sources of pollutants.

Construction of the Proposed Project would generate the following pollutants of concern.

> *NO_x and ROG* – these pollutants are precursors of ozone and are of regional concern. YSAQMD established 10-ton-per-year YSAQMD thresholds for both NO_x and ROG for attainment and maintenance of the national and state AAQS in the region.
>
> *PM_{10} and $PM_{2.5}$* – Emissions of particulate matter (PM) have the potential to result in a localized health impact. YSAQMD established an 80-pound-per-day threshold for PM_{10} emissions to minimize local health impacts. PM emissions arise from two major sources: exhaust PM emissions from off-road

construction equipment and on-road vehicles, fugitive dust from the construction site. PM emissions would be generated from fuel combustion from diesel and gasoline-powered equipment, portable auxiliary equipment, and worker commute vehicles. Fugitive dust, which is often the largest source of PM_{10} emissions, would be generated from loading and unloading of materials, soil disturbance (e.g., soil cut and fill, on-site grading), wind erosion from stockpiles and re-entrainment of settled dust by vehicle and equipment movement. Soil disturbance activities during the construction of the Proposed Project include (1) site preparation activities, such as disking of approximately 411 acres; clearing and grubbing of approximately 156 acres; construction of the staging areas on 32 acres; and construction of access roads and ramps on 17 acres; and (2) construction activities in an area of approximately 200 acres, including excavation of the interior constructed channel network on 63 acres; placement and compaction of dredged material on 12 acres; and filling of agricultural and borrow ditches, construction of interior mounds, construction of the eastern toe berm, construction of the intertidal bench, and construction of the levee breaches, totaling approximately 115 acres.

CO – Similar to ROG and NOx emissions, CO is mostly generated by off-road construction equipment and on-road vehicles for material delivery and work commute trips. Similar to PM, CO can also result in a localized health impact.

Potential impacts resulting from CO_2 generation under the Proposed Project are addressed in Section 3.8.

The emissions inventory for the above-mentioned criteria pollutants (NO_x, ROG, PM_{10}, $PM_{2.5}$, CO) generated during the 2.5-yr construction period is presented in Appendix G. Emissions have been estimated based upon information regarding the seasonal timing of each construction task, anticipated operational hours for each type of construction equipment, quantities of imported construction materials, material delivery methods, and worker commute trips. Two options were analyzed based on the delivery methods for importing rip-rap, fill and aggregate base materials: Option A assumed barging for all import materials, while Option B assumed trucks for all import materials. Appendix F also describes the emissions methodology, assumptions, and input data. As a worst case scenario, results from Option A and the corresponding YSAQMD thresholds are summarized in Table 3.7-7.

Table 3.7-7. Estimated Construction Emissions for Material Delivery Using Barges and Corresponding YSAQMD Significance Thresholds

Pollutants	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2
2018 Emissions (tons)	1.1	6.4	13.0	2.0	0.8	1,853
2019 Emissions (tons)	2.1	15.0	20.8	2.2	1.0	3,528
2020 Emissions (tons)	0.5	3.6	5.0	0.5	0.2	963
Maximum Annual Emissions (tons)	2.1	15.0	20.8	2.2	1.0	3,528
Total Project Emissions (tons)	3.7	24.9	38.8	4.7	2.1	6,344
YSAQMD Significance Threshold (tons)	10		10			
Significance Determination	No		**Yes**			
Maximum Daily Emissions (pounds/day)	86.8	285.7	517.9	78.1	29.3	83,372
YSAQMD Significance Threshold (pounds/day)				80		
Significance Determination				No		

NO_X and ROG

For NO_x and ROG, the Proposed Project would generate 20.8 tons of NO_x in 2019, which would be more than twice the YSAQMD threshold (Table 3.7-7). While implementation of Mitigation Measure 3.7-1.1 would reduce NO_x emissions, they would still be significant. Therefore air quality impacts associated with NO_x would be significant and unavoidable.

Particulate Matter (PM_{10})

Under the Proposed Project, maximum daily PM_{10} emissions would be 78.1 pounds per day, which is lower than the YSAQMD threshold. PM_{10} emissions are estimated using the same methodology as that of the Roadway Construction Model, which is a simplified approach involving estimates of the maximum area (acreage) of land disturbed on a daily basis. Detailed fugitive dust emission estimates associated with materials-handling operations and/or activity/vehicle types cannot be conducted with the current version of the Roadway Construction Model. Instead, the model uses 10 pounds per day per acre for PM_{10} emissions, an emission factor accepted by CARB for projects including watering. However, 10 pounds per day per acre is likely to be an overestimate of PM_{10} emissions from the Proposed Project for the following reasons:

- Although maintenance dewatering would be undertaken throughout the construction period, soils at the Project site would remain relatively moist and some of the construction activities would be carried out in near-saturated soils with no fugitive dust.

- Wherever fugitive dust does arise (e.g., haul roads or other areas of soil disturbance), water trucks would be used.

As few sensitive receptors are present in the immediate vicinity of the Project site, and concentrations of PM_{10} generated by construction activities would not exceed established thresholds, sensitive receptors would not be exposed to high concentrations as a result of the Proposed Project. Overall, the impacts associated with PM_{10} would be less than significant.

However, due to the non-attainment status of the SVAB with respect to PM_{10}, YSAQMD recommends that projects implement feasible best management practices (BMPs) to control fugitive dust regardless of its significance determination, in order to achieve and maintain federal and state air quality standards. Implementation of mitigation measures 3.7-1.1 and 3.7-1.2 would reduce the impacts of fugitive dust (PM_{10}) resulting from to the Proposed Project.

Carbon Monoxide (CO)

YSAQMD does not provide a quantitative annual or daily emission threshold for CO. Therefore, the Proposed Project would have significant impact if CO emissions would violate the State and Federal AAQS for CO (Table 3.7-8). Although the Project site is approximately 1,600 acres, construction activities would occur within a construction zone of approximately 200 acres. It would be unlikely that CO “hot spots” would be formed within the broader 1,600-ac Project site, where localized CO concentrations exceed the State and Federal CO AAQS. The Proposed Project would generate a limited number of on-road trips (Section 3.17) and would not degrade the level of service at intersections where CO “hot spots” could be formed. Therefore, the impacts associated with CO during construction activities would be less than significant.

Overall, construction impacts associated with criteria air pollutant emissions (including ROG, PM and CO) under the Proposed Project would be less than significant and the impacts associated with NO_x would be significant even with mitigation.

Lastly, with respect to long-term operational air quality impacts, post-construction site maintenance, monitoring, and adaptive management activities would generate a low level of criteria air pollutant emissions. Such activities would generate a small number of trips in personal cars and trucks and possible minor construction vehicle operations for repairs and maintenance. However, the low level of vehicular traffic would result in criteria air pollutant emissions far below the significance thresholds, rendering the operational impacts as less than significant.

Mitigation Measure 3.7-1.1

The Proposed Project contractors shall implement the techniques listed in Table 3.7-8, below, to reduce impacts of ozone precursors such as NO_x and ROG, and PM_{10} and $PM_{2.5}$ emissions.

Table 3.7-8. Techniques for Reducing Construction Equipment Exhaust

	Technique
1	Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes [required by California Code of Regulations, Title 13, sections 2449(d)(3) and 2485]. Provide clear signage that posts this requirement for workers at the entrances to the site.
2	Maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified mechanic and determine to be running in proper condition before it is operated.

Mitigation Measure 3.7-1.2

Section 6.1 of the YSAQMD CEQA handbook (YSAQMD 2007) presents a list of feasible measures to control fugitive dust from construction sites. Common techniques for controlling dust (PM_{10}) focus on minimizing dispersal of earth materials during excavation, transport, and disposal activities. Watering and covering (e.g., tarps, surfactants, and vegetation) are frequently relied on to minimize dust at construction sites. The Proposed Project contractors shall implement the following techniques for controlling dust (Table 3.7-9). The implementation details of these techniques shall be adjusted based on field conditions.

Table 3.7-9. Techniques for Reducing Fugitive Dust

Technique	Source Category	Effective
Water all active construction sites (including soil piles, graded areas, unpaved parking areas, staging areas, and access roads) to reduce fugitive dust. Frequency should be based on the type of operation, soil condition, and wind exposure.	Fugitive emissions from active, unpaved construction areas	50%
Haul trucks shall maintain at least 2 ft of freeboard.	Spills from haul trucks	90%
Any haul trucks hauling dirt, sand, or loose materials that would be traveling along freeways or major roadways should be covered.	Spills from haul trucks	90%
Limit vehicle speeds on unpaved roads to 15 miles per hour (MPH).	Unpaved roads	

Technique	Source Category	Effective
Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least four consecutive days).	Wind erosion from storage piles	Up to 80%
Plant vegetative ground cover in disturbed areas as soon as possible.	Wind erosion from storage piles	5–99% (based on planting plan)
Cover inactive storage piles.	Wind erosion from storage piles	Up to 90%
Sweep streets if visible soil material is carried out from the construction site.	On-road entrained PM_{10}	14%
Treat accesses to a distance of 100 ft from the paved road with a 6 to 12 inch layer of wood chips or mulch.	Mud/dirt carryout on-road entrained PM_{10}	27–33%
Treat accesses to a distance of 100 ft from the paved road with a 6-inch layer of gravel.	Mud/dirt carryout on-road entrained PM_{10}	42–52%

Note: The effectiveness of two or more mitigation measures that address the same source of emissions would not be the sum of both measures.

Impact significance

Significant and Unavoidable

Impact 3.7-2: Conflict with or obstruct applicable general plans or regional air quality plans

YSAQMD was designated as non-attainment for ozone; as a result, YSAQMD and four other air districts in the SVAB jointly prepared and adopted the Regional Ozone Plan. YSAQMD's ten-tons-per-year thresholds for the ozone precursors (ROG and NOx) were established to be consistent with this Regional Ozone Plan. As discussed in Impact 3.7-1, the maximum annual NOx emissions for both options of the Proposed Project would be more than twice of the YSAQMD threshold, and the implementation of the mitigation measures would not reduce the NOx emissions to a below threshold level, so the Project will conflict with and obstruct the Regional Ozone Plan. Therefore, the Project would have a significant and unavoidable impact with respect to NOx emissions impacts even with implementation of mitigation measures 3.7-1.1 and 3.7-1.2.

The Proposed Project would also generate PM_{10} and CO emissions. However, because the PM_{10} and CO thresholds are designed to minimize local impacts, projected PM_{10} and CO emissions under the Proposed Project would not be in conflict with any regional plans, regardless of the exceedance of these thresholds.

A project is deemed inconsistent with air quality plans if it would result in substantial population and/or employment opportunities that exceed growth estimates included in the applicable local general plans or air quality plan. The Proposed Project would not result in substantial population growth, as it would only restore, enhance, and preserve habitat. Construction of the Proposed Project would involve up to 30 or 40 full-time construction workers during the 2.5-year construction period. During the post-construction phase, a few full-time workers may be required to conduct surveys and other monitoring work. However, not all of these positions would be filled by local residents. For example, the contractor may bring workers from other areas to perform the work. As a result, the impacts to local employment and population growth would be temporary and minimal.

Impact significance

Significant and Unavoidable

Impact 3.7-3: Expose sensitive receptors to air pollutants and cause higher health risks

The Proposed Project would generate criteria air pollutants as well as other pollutants during the 2.5-year construction period (see also Impact 3.7-1). Diesel Particulate Matter (DPM) produced by diesel-powered equipment is considered to be a TAC under California law. However, the Project site is situated in a rural, agricultural setting within the Yolo Bypass, a vast flood control zone which is not densely populated. While the Project site is approximately 1,600 ac, construction activities would occur within a construction zone of approximately 200 ac. Air pollutant concentrations would decrease with distance from the source due to atmospheric dispersion; therefore, pollutants would be unlikely to form localized DPM hot spots and expose sensitive receptors to concentrations that could cause health risks. Sensitive receptors existing in the immediate vicinity of the Project site are limited to a small number of residences, including a house that is not permanently occupied, the live-aboard residences occupying vessels at the Arrowhead Harbor Marina, and residences located on the adjacent Ryer Island. Overall, substantial DPM or other TAC levels would not represent a health risk to sensitive receptors during Project construction. In addition, Project construction would not involve the use of hazardous materials that could result in the release of carcinogenic substances or TAC.

Impact significance

Less than significant

Impact 3.7-4: Expose sensitive receptors to objectionable odors

The Project site is situated in a rural, agricultural environment within the Yolo Bypass, a vast flood zone which is not densely populated. Sensitive receptors existing in the immediate vicinity of the Project site are limited to a small number of residences, including a house that is not permanently occupied, the live-aboard residences occupying vessels at the Arrowhead Harbor Marina, and residences located on the adjacent Ryer Island. A potential short-term source of objectionable odors under the Proposed Project includes emissions from diesel-powered equipment used during the 2.5-year construction period. While the Project site is approximately 1,600 ac, equipment emissions would occur within a construction zone of approximately 200 ac. The latter is sufficiently large that odor concentrations would be dispersed and, given the generally low population density of the local area, would not expose a substantial number of people to objectionable concentrations. As a result, short-term construction-related odors under the Proposed Project would be less than significant.

With respect to the long-term, the Proposed Project does not involve the development of houses or other facilities that would place sensitive receptors near any existing or planned sources of odor. Thus, in the long-term, there would be no impact of the Proposed Project on sensitive receptors with respect to objectionable odors.

Impact significance

Less than significant

3.8 Greenhouse Gases

This section describes the projected impacts of Proposed Project-related GHG emissions on global climate change. The Proposed Project involves material transportation, site preparation, and construction activities that require the use of emission-generating equipment. GHG emissions analysis is based on the DWR Climate Action Plan –Phase 1: Greenhouse Gas Emissions Reduction Plan (GGERP).

3.8.1 Setting

Environmental setting

GHGs in the atmosphere increase the amount of reflected solar radiation that is absorbed, resulting in the increase of global average temperature. Increases in the concentrations of GHGs in the Earth’s atmosphere are thought to be the main cause of human-induced climate change (Cubasch et al. 2013). The environmental setting for GHG emissions is global.

Legal and regulatory setting

In May 2012, DWR adopted the DWR Climate Action Plan-Phase 1: GGERP (DWR 2012c), which details DWR's efforts to reduce its GHG emissions consistent with Executive Order S-3-05 and the Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32). DWR also adopted the Initial Study/Negative Declaration prepared for the GGERP in accordance with the CEQA Guidelines review and public process. Both the GGERP and Initial Study/Negative Declaration are incorporated herein by reference and are available at: http://www.water.ca.gov/climatechange/CAP.cfm. The GGERP provides estimates of historical (back to 1990), current, and future GHG emissions related to operations, construction, maintenance, and business practices (e.g. building-related energy use). The GGERP specifies aggressive 2020 and 2050 emission reduction goals and identifies a list of GHG emissions reduction measures to achieve these goals.

DWR specifically prepared its GGERP as a "Plan for the Reduction of Greenhouse Gas Emissions" for purposes of CEQA Guidelines section 15183.5. That section provides that such a document, which must meet certain specified requirements, "may be used in the cumulative impacts analysis of later projects." Because global climate change, by its very nature, is a global cumulative impact, an individual project's compliance with a qualifying GHG Reduction Plan may suffice to mitigate the project's incremental contribution to that cumulative impact to a level that is not "cumulatively considerable." (See CEQA Guidelines, Section 15064, subd. (h)(3).)

More specifically, "[l]ater project-specific environmental documents may tier from and/or incorporate by reference" the "programmatic review" conducted for the GHG emissions reduction plan. "An environmental document that relies on a greenhouse gas reduction plan for a cumulative impacts analysis must identify those requirements specified in the plan that apply to the project, and, if those requirements are not otherwise binding and enforceable, incorporate those requirements as mitigation measures applicable to the project." (CEQA Guidelines Section 15183.5, subd. (b)(2).)

Criteria for determining significance are based on Section 12 of the GGERP, which outlines the steps that each DWR project would take to demonstrate consistency with the GGERP. These steps include:

1. Analysis of GHG emissions from construction of the Proposed Project;
2. Determination that the construction emissions from the Proposed Project do not exceed the levels of construction emissions analyzed in the GGERP;
3. Incorporation of DWR's project-level GHG emissions reduction strategies into the design of the Proposed Project;
4. Determination that the Proposed Project does not conflict with DWR's ability to implement any of the "Specific Action" GHG emissions reduction measures identified in the GGERP; and,
5. Determination that the Proposed Project would not add electricity demands to the State Water Project (SWP) system that could alter DWR's emissions reduction trajectory in such a way as to impede its ability to meet its emissions reduction goals.

Consistent with the requirements outlined above, a GGERP Consistency Determination Checklist is attached documenting that the Proposed Project has met each of the required elements (Appendix H).

3.8.2 Impacts and mitigation

Impact 3.8-1: Proposed Project-related GHG emissions

Construction-related activities and transport of material on and offsite would generate GHG emissions. An equipment list for the Proposed Project was developed with the assistance of a DWR Division of Engineering Principal Engineer. The equipment list and emission estimates for each equipment type are included in Appendix G, Prospect Island Restoration Project Air Quality Calculation.

The equipment list was then input into models for air quality calculations using the methods described for Air Quality Impact 3.7-1. The CO_2 output from the air quality calculations, summarized in Table 3.3-7, were converted into carbon dioxide equivalents (CO_2e) by dividing the CO_2 output by 99.74%. According to the USEPA's emission factors, CO_2 accounts for 99.74 of CO_2e for medium and heavy duty trucks (USEPA 2014).

Operations, maintenance and business activity emissions are identified (inventoried) each year as part of DWR's verified emissions reporting to The Climate Registry done by the DWR State Water Project Power and Risk Office. Therefore, emissions generated by activities of DWR staff and equipment that are accounted for in The Climate Registry inventory need not be accounted for again for CEQA purposes.

Based on the analysis provided in the GGERP and the demonstration that the Proposed Project is consistent with the GGERP (as shown in the attached Consistency Determination Checklist), DWR as the lead agency has determined that the Proposed Project's incremental contribution to the cumulative impact of increasing atmospheric levels of GHGs is less than cumulatively considerable and, therefore, less than significant.

Impact significance
Less than significant

3.9 Mineral and Gas Resources

This section describes mineral and natural gas resources at the Project site and assesses the potential impacts of the Proposed Project on mineral and natural gas rights over, under, or across the Project site held by third party entities. The analysis is based on readily available information on area gas wells, including published reports, publicly available websites, and applicable plans and policies.

3.9.1 Setting

Environmental setting

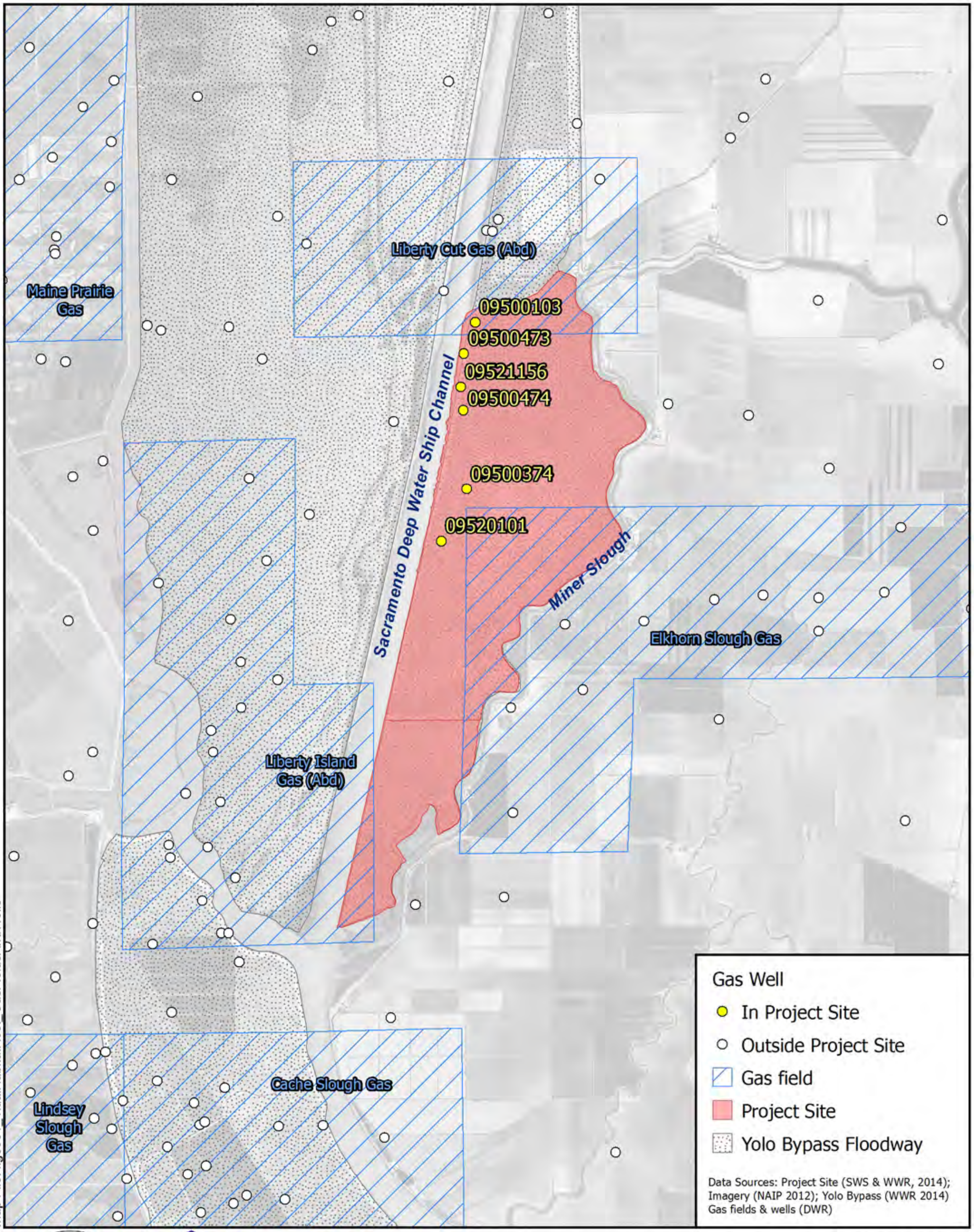
Natural gas
There are three known natural gas fields that underlie portions of the Project site, including Liberty Cut, Liberty Island, and Elkhorn Slough Gas Fields (Figure 3.9-1). The Liberty Cut Gas Field has a maximum confirmed acreage of 690 ac and underlies the northernmost portion of the Project site. This field was discovered in 1953 and abandoned in 1965 (DOGGR 1992). The Liberty Island Gas Field has a maximum productive area of 690 ac and underlies the southwestern tip of the Project site. This field was discovered in 1960 and abandoned in 1984. The Elkhorn Slough Gas Field, discovered in the 1990s, underlies the east central portion of the Project site, and is still in active production (DOGGR 2014). There are six natural gas exploration wells located within the northwestern portion of Prospect Island (DOGGR 2014):

- Well 09500374, Chevron USA, plugged and abandoned in 1946;
- Well 09500474, Arcady Oil Company, plugged and abandoned in 1954;
- Well 09500473, Arcady Oil Company, plugged and abandoned in 1955
- Well 09500103, Arcady Oil Company, plugged and abandoned in 1965

- Well 09520101, Union Oil Company of California, plugged and abandoned in 1969; and
- Well 09521156 Rosetta Resources Operating LLP, plugged and abandoned in 2002.

Five of the wells were dry holes (non-productive) and abandoned shortly after drilling. However, one of the wells (09500103), completed in 1956 in the Liberty Cut Gas Field, was idled from 1956 until 1965, at which time it was abandoned. The most recent exploratory gas drilling on Prospect Island occurred in 2002 and this well (09521156) was found to be a dry hole (non-productive) and was subsequently abandoned.

USBR holds natural gas rights on the northern portion of the property. Natural gas rights on the southern portion of the property are held by a suite of owners who held property rights prior to the site's condemnation (P. Carlson, DWR, pers. comm., March 2015).



Map File: fig3901_TidalHabitatRest_GasFieldsAndWells

1:50,000 (1 in = 0.8 miles at letter size)

0 0.5 1 Mi

0 0.5 1 1.5 Km

Figure 3.9-1

Gas Fields and Wells in Vicinity of the Project Site

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

Non-fuel mineral resources

Non-fuel mineral resources mined or produced within Solano County include mercury, sand, gravel, clay, stone products, calcium, and sulfur (Solano County Board of Supervisors 2008). The CGS and USGS record past or ongoing extraction of some non-fuel mineral resources, including peat, sand, and gravel throughout the Delta (Clinkenbeard 2012, USGS 2013). There are no active mines or mineral processing facilities and no recorded past mine locations within approximately four miles of the Project site. Additionally, the nearest Mineral Resource Zones (MRZs) are within approximately 11 miles of the Project site.

Legal and regulatory setting

Federal laws

Unless otherwise noted, the Proposed Project would comply with the following federal laws.

Surface Mining Control and Reclamation Act of 1977

The Department of the Interior's Office of Surface Mining regulates the environmental effects of coal mining under the Surface Mining Control and Reclamation Act of 1977 (SMCRA). There are no known coal mines in the study area that would be regulated pursuant to SMCRA.

State laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

California Department of Conservation, Division of Oil, Gas, and Geothermal Resources Construction-site Plan Review Program

DOGGR regulates drilling, operation, maintenance, and abandonment of oil, gas, and geothermal wells. As part of DOGGR's responsibilities for implementing PRC Section 3208.1, districts have developed the Construction-site Plan Review Program to assist local agencies in identifying and reviewing the status of oil or gas wells near proposed development. The program is aimed at addressing potentially dangerous issues associated with development near oil or gas wells. DOGGR serves in an advisory role to make relevant information available to local agencies. Section 3208.1 of the PRC states that if any property owner, developer, or local permitting agency either fails to obtain an opinion from DOGGR, or fails to follow the advice of DOGGR when development occurs near an oil or gas well, then the owner of the property on which the well is located may be responsible for re-abandonment costs should a future problem arise with the well. To use the DOGGR Well Review Program, the developer or property owner submits a completed Well Review Program Application to DOGGR (DOGGR 2007). Before issuing building or grading permits, local permitting agencies review and implement DOGGR's preconstruction well requirements. Interaction between local permitting agencies and DOGGR helps resolve land-use issues and allows for responsible development in oil and gas fields.

Surface Mining and Reclamation Act of 1975

The California law that regulates mining activities is the Surface Mining and Reclamation Act of 1975 (SMARA, PRC Section 2710 et seq.). This law's purpose is to create and maintain an effective and comprehensive surface mining and reclamation policy with regulation of surface mining operations to ensure that adverse environmental effects are prevented or minimized and that mined lands are reclaimed to a usable condition that is readily adaptable for alternative land uses. Production and conservation of minerals are encouraged, and consideration is given to values relating to recreation, wildlife, range and forage, and aesthetic enjoyment, while eliminating residual hazards to public health and safety. These goals are achieved through land use planning by allowing jurisdictions to balance the economic benefits of resource extraction with the need to provide other land uses.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local ordinances and policies.

Delta Protection Commission

The Delta Protection Act of 1992 established the Delta Protection Commission and required the Commission to prepare and adopt a Land Use and Resource Management Plan. Section 20050 of the Land Use and Resource Management Plan (LURMP) for the Primary Zone of the Delta (Delta Protection Commission 2010) addresses natural gas wells and pipelines.

Solano County General Plan

Relevant goals and policies of the Solano County General Plan (Solano County Board of Supervisors 2008) are listed below.

Policy RS.P-33: The County shall preserve, for future use, areas with important mineral resources by preventing residential, commercial, and industrial development that would be incompatible with mining practices to the extent feasible.

Policy RS.P-34: Ensure that mineral extraction operations are performed in a manner compatible with land uses on the site and surrounding area and do not adversely affect the environment. At the end of such operations, ensure that the site is restored to conform with SMARA requirements and to a use compatible with surrounding land uses.

Policy RS.P-55: Require responsible extraction, storage, and transportation of natural gas resources that minimize the impact on the natural environment.

Implementation Regulation RS.I-17: Evaluate impacts related to extracting mineral resources from new areas as part of the required permitting process to ensure that remediation occurs after minerals are extracted. Comply with regulations found in SMARA.

Solano County Code

Chapter 29 of the Solano County Code contains requirements for permitting and reclamation of mines in compliance with SMARA.

3.9.2 Significance criteria

Criteria for determining significant impacts are based on the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that the Proposed Project would have a significant impact on mineral resources if it would:

- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state**.**
- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan**.**

3.9.3 Impacts and mitigation

Impact 3.9-1: Loss of a known mineral resource that would be of value to the region and residents of the state

Prospect Island is currently partially flooded and would remain so under the Proposed Project. The three gas fields underlying portions of the Project site, including two abandoned gas fields and one active gas field (Elkhorn Slough Gas Field), would still be accessible via directional drilling and thus there would not be a change compared with existing conditions.

There is only one active gas well in the area. It is on Ryer Island, just east of the Project site. No activities are planned to occur on Ryer Island as part of the Proposed Project. Road construction, dredging, excavation, and grading activities on Prospect Island would not be expected to affect production at the active Ryer Island gas well. Therefore, there would be no impact to known mineral resources due to Proposed Project activities.

Impact significance

No impact

Impact 3.9-2: Loss of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan

As described in Section 3.9 Mineral Resources – Setting, there are no active mines or mineral processing facilities and no recorded past mine locations within four miles of the Project site. Additionally, there are no Mineral Resource Zones (MRZ) within 11 miles of the Project site. Therefore, there would be no impact to known locally important mineral resource recovery sites.

Impact significance

No impact

3.10 Noise

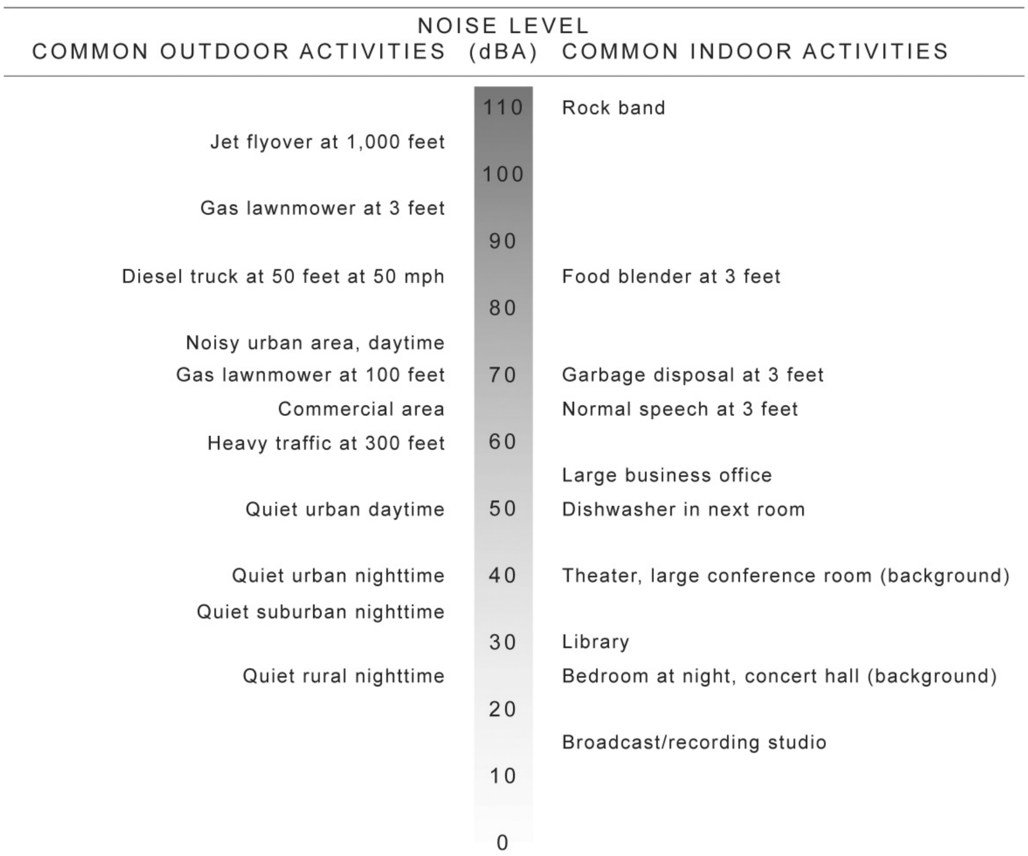
This section discusses noise concepts and characterizes ambient noise in the vicinity of Prospect Island. It then assesses the potential effects of short-term construction-related noise, as well as long-term operation and maintenance activities associated with implementation of the Proposed Project, on sensitive human receptors. Mitigation measures are identified to reduce significant impacts. Noise impacts to wildlife are described in Section 3.4 Wetland and Terrestrial Resources.

Noise characteristics

The following terms are used to characterize noise throughout this section:

- *Ambient Noise*: All noise sources audible at a particular location. In many cases, the term "ambient" is used to describe an existing or pre-project condition, such as the setting in an environmental noise study.
- *Attenuation*: The reduction of noise from the source.
- *Decibel (dB)*: A unit of sound energy intensity measured using the logarithmic ratio of the square of the ambient sound pressure level compared to the pressure from the faintest sound detectable by a young person with good auditory acuity.
- *A-Weighting*: A frequency-response adjustment of a sound-level meter that conditions the output signal to approximate human response. (A-weighted decibels are referred to in this EIR as "dBA."); Figure 3.10-1 illustrates common noises and their respective dBAs.
- *Community Noise Equivalent Level (CNEL)*: The 24-hour average noise level with noise occurring during evening hours (7–10 p.m.) weighted by a factor of 3 and noise occurring during nighttime hours (10 p.m.–7 a.m.) weighted by a factor of 10 before averaging.
- L_{dn}: Day/night average sound level. Similar to CNEL but with no evening weighting.
- L_{eq}: Equivalent or energy-averaged sound level.
- L_{Max}: The highest sound level measured over a given period of time.

In an ideal laboratory setting, the human ear can discern a difference in sound level of +/-1 dBA, which consequently is the accuracy of sound level meters and sound propagation computer models. Outside of a laboratory setting, most people cannot discern a change in noise levels that differs by less than 3 dBA between pre-project and post-project exposure if the change occurs under ambient conditions. A change from 3 to 5 dBA may be noticed by some individuals who are extremely sensitive to changes in noise. Typically, a 5 dBA increase is readily noticeable, and the human ear perceives a 10 dBA increase as twice as loud (Caltrans 2009).



Source:Caltrans 2009.

Figure 3.10-1. Noise Levels from Common Activities

3.10.1 Setting

Environmental setting

The Project site is characterized by an agricultural/open space setting. Prospect Island is surrounded on three sides by waterways, with the Sacramento River Deep Water Ship Channel on the west, Miner Slough on the east, and a wildlife area at the confluence of the two water bodies to the south.

Typical noise sources in the Proposed Project area are primarily from small boat traffic frequenting the surrounding waterways and from vehicle traffic on State Route 84 adjacent to Miner Slough to the east. Infrequent noises from ships in the DWSC and airplane flyovers associated with agricultural practices also generate occasional noise sources in the Proposed Project area.

Existing noise levels

The most recent assessment of ambient noise levels near the Proposed Project area was undertaken for the Solano County General Plan EIR (Solano County Board of Supervisors 2008). One of the locations evaluated by the EIR was a community monitoring station located south of Elevator Road and west of Ryer Road, just east of the Proposed Project area. The community noise measurement at this location recorded an average sound level of 46 dBA L_{dn} and a maximum of 59 dBA L_{Max}. The Solano County General Plan EIR also utilized the Federal Highway Administration (FHWA) Highway Traffic Nose Prediction Model to predict the traffic noise levels along State Route 84 near the Solano County line (approximately 2 miles from the Proposed Project area) utilizing the data collected from 11 noise-monitoring locations. The FHWA model estimated that the segment along State Route 84 measured an average sound level of 61 dBA L_{dn} 100 ft from the centerline of the vehicle pathway. Both the community noise monitoring station located south of Elevator Road and west of Ryer Road, and the modeled noise levels along State Route 84 near the Solano County line are representative of the ambient noise levels at the Project site, as they experience the same typical noise sources and surrounding land uses.

Sensitive receptors

Sensitive receptors for noise impacts are individuals who would experience a substantial increase in ambient noise levels as a result of project related activities. These activities include both short-term construction generated noise and long-term operational noises. Typically, individuals at residences, churches, schools, or hospitals are most sensitive as the ambient noise levels at these locations are quieter than those at businesses, restaurants, or in transportation hubs. As such, any receptor of noise generated by a project activity may be a sensitive receptor; however, whether the noise adversely impacts the receptor is dependent upon how greatly the project-related noise levels vary from ambient noise levels.

While the Project site is located in an agricultural/open space setting, several sensitive receptors (residents, schools, cemeteries, places of worship, etc.) do exist within the Proposed Project vicinity. The Hall property is not currently occupied. The closest potential sensitive receptor is a house that is not permanently occupied and located approximately 100 ft away from the Project site, along the eastern periphery of Prospect Island. The next closest residences are those located at the Arrowhead Harbor Marina (Arrowhead Harbor Marina 2014), which is located along Holland Road. These "live aboard" residences occupy vessels full time at the marina, and are located 175 ft north of the northern edge of the Proposed Project area. A number of residences are located approximately 500 to 1,500 ft east, southeast, and south of the Project site, across Miner Slough on Ryer Island. The nearest sensitive receptors other than residences (e.g., schools and placed of worship) are located approximately 5 miles southwest within the City of Rio Vista.

Regulatory setting

Federal regulations

Unless otherwise noted, the Proposed Project would comply with the following federal regulations.

Federal vehicle noise limits

Federal regulations establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under Title 40 CFR Part 205, Subpart B. The federal truck pass-by noise standard is 80 dB at 15 meters (about 50 ft) from the centerline of the vehicle pathway. These standards are implemented through regulatory controls on truck manufacturers.

State regulations

Unless otherwise noted, the Proposed Project would comply with the following state regulations.

The State of California vehicle noise limits

The State of California establishes noise limits for vehicles licensed to operate on public roads. The pass-by standard for heavy trucks is consistent with the federal limit of 80 dB. The pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dB at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanctions on vehicle operators by state and local law enforcement officials.

The State of California community noise levels

The State of California has established guidelines for acceptable community noise levels based upon the CNEL rating scale to ensure that noise exposure is considered in any development, as shown in Table 3.10-1. CNEL-based standards apply to noise sources whose noise generation is preempted from local control (such as from on-road vehicles, trains, airplanes, etc.) and are used to make land use decisions as to the suitability of a given site for its intended use. These CNEL-based standards are provided in the Solano County General Plan under the General Plan Public Health and Safety Chapter.

Table 3.10-1. Solano County General Plan, Land Use Noise Compatibility Guidelines

Land Use Category	Community Noise Exposure (Ldn or CNEL, dBA)			
	Normally Acceptable[1]	Conditionally Acceptable[2]	Normally Unacceptable[3]	Clearly Unacceptable[4]
Residential—Low Density Single Family, Duplex, Mobile Home	<60	55–70	70–75	75+
Residential—Multifamily	<65	60–70	70–75	75+
Transient Lodging—Motel, Hotel	<65	60–70	70–80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	<70	60–70	70–80	80+
Auditoriums, Concert Halls, Amphitheaters	-	<70	65+	-
Sports Arena, Outdoor Spectator Sports	-	<75	70+	-
Playgrounds, Neighborhood Parks	<70	-	67.5–75	72.5+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<75	-	70–80	80+
Office Building, Business Commercial, and Professional	<70	67.5–77.5	75+	-
Industrial, Manufacturing, Utilities, Agriculture	<75	70–80	75+	-

Source: Solano County General Plan (Solano County Board of Supervisors 2008) Table HS-2

1 Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
2 New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning would normally suffice.
3 New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor areas must be shielded.
4 New construction or development should generally not be undertaken.
5 These standards are not applicable for development within the airport compatibility review area. Development in the airport compatibility review areas are subject to standards in the applicable airport land use plan.

Local ordinances

Unless otherwise noted, the Proposed Project would comply with the following local regulations.

Solano County General Plan

The Noise Section of the Solano County General Plan Public Health and Safety Chapter provides Land Use Noise Compatibility Guidelines for different land use categories noise exposure levels (Solano County Board of Supervisors 2008). In general, the noise standards specified by the county are designed to prevent annoyance or sleep disruption to sensitive receptors. Table 3.10-1 below shows the acceptable noise levels for various land use categories, and is used when determining a project's noise impact. The Proposed Project site falls under the land use designation "Industrial, Manufacturing, Utilities, Agriculture", for which there is no "Clearly Unacceptable" noise exposure limit. However, the General Plan does state that noise levels over 75 dB L_{dn} under normal circumstances would be unacceptable.

3.10.2 Significance criteria

The CEQA Guidelines define significant impacts as those that cause standards to be exceeded where they are currently met. An impact is also considered significant if it "substantially" exacerbates an existing significant impact to the noise environment, or creates an exposure of persons to noise levels exceeding standards established in the local general plan or other applicable regulations.

While "substantially" is not defined under CEQA guidelines, typically an increase between 3-5 dBA L_{dn} or greater resulting from the Proposed Project on sensitive land uses would be considered a significant impact.

Adverse impacts to noise would be considered significant if the Proposed Project would:

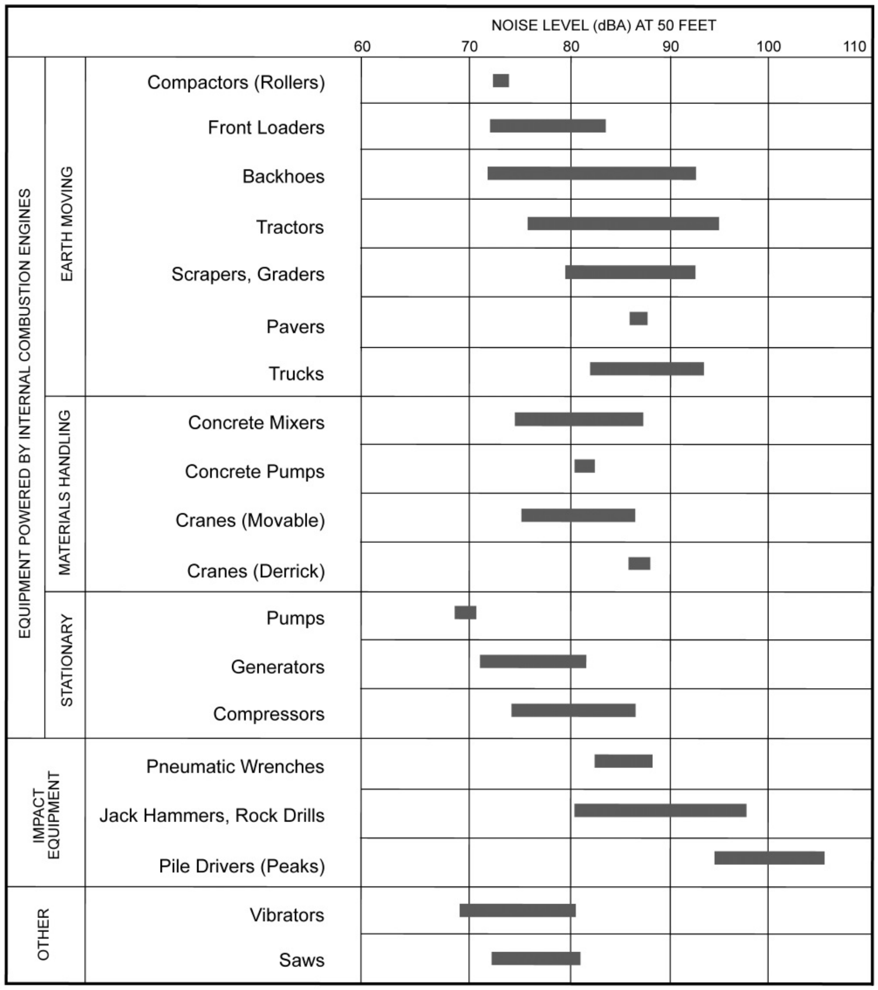
- Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies
- Result in a substantial temporary or periodic increase in ambient noise levels in the Proposed Project vicinity above levels existing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

3.10.3 Impacts and mitigation

Impact 3.10-1: Potential for short-term noise disturbance to nearby residents

While Solano County does not have a specific ordinance regarding construction-related noise emissions, proposed construction activities would substantially increase short-term noise levels at residences in the Proposed Project vicinity.

Construction generated noise levels in the Proposed Project area would fluctuate depending on the location, and the particular type, number, and duration of equipment used. Figure 3.10-2 shows the typical noise levels associated with different construction stages/phases, and the typical noise levels produced by various types of construction equipment. The range in noise levels in Figure 3.10-2 is intended to illustrate the long-term averaged (L_{dn}) noise levels at the lower end of the range, and the short-term maximum levels at the upper end of the range. Table 3.10-2 lists the anticipated construction equipment for the Proposed Project and its associated L_{eq} noise levels.



Source: USEPA 1971

Average noise levels correspond to a distance of 50 ft from the noisiest piece of equipment associated with a given phase of construction and 200 ft from the rest of the equipment associated with that phase.

Figure 3.10-2. Noise Produced by Various Pieces of Construction Equipment

Table 3.10-2. Typical Noise Levels from Proposed Construction Equipment

Proposed Construction Equipment	Estimated Duration (Days)	Noise Level (dBA L_{eq} at 50 feet)
Front Loaders and Bulldozers	960	76
Excavators	926	81
Pile Driving Crane	92	101
Graders and Scrapers	920	81
Dewatering Pumps	494	79
Compactor/Roller	185	73
Tractor/Backhoe/Truck	960	76
Dredger	69	75–88

Source: DOT 2006

Under the Proposed Project, restoration activities such as vegetation clearing, traffic from workforce transportation, import of materials by barge and truck, and operation of dewatering pumps and construction equipment, would result in on-island short-term construction noise. The nearest sensitive receptor is a house that is not permanently occupied located approximately 100 ft away from proposed construction activities on a privately owned parcel adjacent to the Project site. Because noise attenuates at 6 dBA per doubling of distance, this property could experience an outside maximum momentary noise level of approximately 90 dBA L_{Max}, and time-averaged outside construction noise levels of approximately 70 dBA L_{dn} while construction is occurring. Both the maximum construction noise level of 90 dBA L_{Max} and the long-term construction noise level of 70 L_{dn} are well above the ambient levels of 59 dBA L_{Max} and 46 L_{dn} respectively, and above acceptable noise level for residential land uses. The anticipated noise levels described above are for the loudest equipment proposed to be working within 100 ft of the privately owned parcel. These noise levels would occur for a period of up to 2 years, but would not occur within 100 ft for that amount of time. However, overall the increase in noise levels from Proposed Project construction activities, while within the vicinity of the privately owned parcel, would constitute a potentially significant impact. Implementation of Mitigation Measure 3.10-1.1 would reduce this impact to a less-than-significant level.

Live-aboard residences at Arrowhead Harbor Marina are located approximately 175 ft from the Project site and are situated behind Prospect Island's northeast levee (Figure 2.2-3). These residences would be sheltered from the majority of the construction. While ground clearing/grading occurs, residences at Arrowhead Harbor Marina would experience outside noise levels of slightly more than 83 dBA L_{Max} and about 76 dBA L_{dn} without the protection of the levee to buffer the noise. As such, these residences would not experience a significant impact from the increase in construction related noise levels.

The nearest residences on Ryer Island are located approximately 500 ft to the east of the Project site. These residences, like those at Arrowhead Harbor Marina are located behind high levees, and as a result would be buffered from the majority of the noises generated by the Proposed Project construction. Given the distance from the Proposed Project to Ryer Island these residences would experience temporary outside noise levels of approximately 75 dBA L_{Max} and about 60 L_{dn} without the levees acting as a sound buffer. As a result the Proposed Project would not significantly impact these residences.

In addition to on-island construction equipment noise, the Proposed Project also would generate off site noise from haul trucks. Trucks would utilize existing roads and highways, primarily Holland Road and Highway 84 during regular working hours (e.g., Monday–Friday during the daylight hours). These haul trips would create additional noise along these routes, which would be audible to sensitive receptors. Specifically, residences along Holland Road and Highway 84 (e.g., live-aboard residences at the Arrowhead Harbor Marina) would experience additional noise while trucks are hauling materials to and from the Proposed Project. As shown in Table 3.10-3 below the Proposed Project is estimated to generate approximately 14 truckloads per day during the most intense hauling activities, and would result in 1,100 total haul trips over a four month period. In perspective, 100 truck loads per day would produce 42 dBA CNEL at 100 ft. Existing traffic noise at 100 ft was calculated to be 61 dBA CNEL for Highway 84 in the Solano County General Plan (2008), and similar noise levels are expected for Holland Road due to the same traffic types (i.e., agricultural equipment driving along the road, and vehicles traveling to Arrowhead Harbor Marina). Trucks hauling materials for the Proposed Project would increase average noise levels to adjacent residences within 100 ft by less-than 0.2 dBA. An increase in noise of 3 dBA or more is considered significant for ambient noise levels between 60 and 65 dBA L_{dn} (Federal Interagency Committee on Noise 1992). Therefore, while the hauling of materials by truck may temporarily add to additional noise levels along Holland Road and Highway 84, the additional trucks would not add to the existing noise levels by more than 3 dBA, and as such the impact to residences along those roads would be less than significant.

Table 3.10-3. Schedule of Estimated Daily Haul Trucks

Type	Maximum Trips/Day	Approx. Duration	Total Trips	Estimated Dates
South Levee Repair Materials (by barge)	1	27 Days	5	May, 2018
Materials Delivery (by truck)	3	5 Months	216	June-September, 2019
Debris Removal (by truck)	14	4 Months	1,100	September, 2018 - Jnauary, 2019

Notes: Assumes work would occur five days per week for eight hours per day.

Mitigation Measure 3.10-1.1

The following mitigation measure would reduce the noise impact to residences in the Project area to a less-than-significant level:

1. The construction contractor shall locate stationary noise sources as far from existing residences as possible.

2. The DWR shall identify a disturbance coordinator, and the name and phone number of this person shall be conspicuously be posted at the Project site in an area that can be accessed by the general public. If noise complaints are received, the disturbance coordinator shall respond to the complaints and shall take the steps necessary to mitigate the problem.

Impact significance

Less than significant with mitigation

Impact 3.10-2: Potential for long-term increases in ambient noise levels in the Proposed Project vicinity

The Proposed Project would continue to require infrequent operations and maintenance, and monitoring activities within Prospect Island after construction. These activities would only involve temporary actions, many of which occur under current conditions, such as mowing, DWSC and northern cross levee road maintenance, and weed abatement. These activities would not involve new long-term stationary noise sources. Therefore, the Proposed Project would not have a significant impact on long-term ambient noise levels in the vicinity.

Impact significance

Less than significant

Impact 3.10-3: Potential for sensitive receptors to be exposed to excessive ground-borne vibrations during construction-related activities

The Proposed Project may involve the construction of a sheet pile cut-off wall for levee repairs at the end of the Miner Slough spur channel (just northwest of the Hall property). Construction of the cut-off wall may generate temporary ground-borne vibrations while the sheet piles are driven into the ground. Sheet piles would most likely be installed out of water using vibratory hammers; however, an impact pile driver within water may be necessary. The nearest sensitive receptor (a residence) is located over 1,500 ft to the east on Ryer Island. Assuming the largest type of pile driver would be used (e.g., crane-mounted pile driver) either out of water or in-water, these residences would receive a maximum ground-borne vibration peak-particle velocity (PPV) of less-than 0.001 inches per second (in/sec). As shown in Table 3.10-4 below, vibration levels under 0.035 in/sec PPV are barely perceptible to humans. Thus, the Proposed Project would have no impact on sensitive receptors due to ground-borne vibrations.

Table 3.10-4. Human Response to Transient Vibration

Vibration Level (in/sec PPV)	Human Response
2.0	Severe
0.9	Strongly perceptible
0.24	Distinctly perceptible
0.035	Barely perceptible

Source: Caltrans 2004

Impact significance

No impact

HUMAN RESOURCES

3.11 Aesthetics

This section describes visual quality of the Project site and vicinity, and assesses the visual quality impacts of the Proposed Project. The Proposed Project involves breaching portions of the Miner Slough levee and changing portions of the site from open water, marshes, and uplands to tidal wetland, as well as constructing a levee toe berm, and possible access improvements. Visual quality issues addressed include effects on scenic vistas, other scenic resources, visual character, and light and glare. This analysis is based on a field reconnaissance and review of applicable plans and policies.

3.11.1 Setting

Environmental setting

Agricultural, open space, and recreational landscapes characterize the visual character of Prospect Island and surrounding views. Viewers include recreational users of the area (including boaters, anglers, bird watchers), as well as motorists on nearby roadways with views of the site.

The interior of the Project site is generally flat and is surrounded by levees obscuring views into the interior of the site from adjacent waterways and low-lying areas. The existing topography of Prospect Island is flat and low-lying, gently sloping up to the north. Site elevations range in the interior of the island from approximately 3 ft below MTL to 5 ft above MTL (Figure 2.2-2), with the levees rising about 10–15 ft above the interior of the island. The topography of the south property is somewhat higher than the northern part of the Island, reflecting its use for dredged material placement. The south property has had levee breaches that are partially repaired.

Views of the Project site are mostly limited to the levees surrounding the site, which are vegetated with trees and shrubs, and also include Miner Slough, a developed marina (Arrowhead Harbor Marina), and two barely visible residential properties. Occasional views of the interior of the site are available where the levee dips and/or levee vegetation is sparse. Views of the interior include open water, freshwater marsh, riparian vegetation, blackberry, and oak and willow trees. The channels, open water, levees, and marshes on and adjacent to the site also afford views of wildlife and their habitat, which add to the area's visual interest. Representative views of the site are shown in Figure 3.11-1 through Figure 3.11-4.

Public viewpoints of the Prospect Island Tidal Marsh Restoration Project site are primarily from State Route (SR) 84, which runs atop the entire length of the Ryer Island levee directly across Miner Slough from Prospect Island (east and south of the Island), as well as from the Arrowhead Harbor Marina (directly north of the Island). Views from this road are primarily of the Prospect Island Miner Slough levee, but, in areas where the levee is lower and/or vegetation sparse, views also include waters of the interior of the island. Boaters have views of the levees surrounding the site from the Marina, Miner Slough (on the east side of the Island), and the DWSC (west of the Island).

Figure 3.11-1. Westerly Views of South End of Prospect Island from State Route 84

Figure 3.11-2. View of Miner Slough Looking West from Ryer Island Levee

Figure 3.11-3. View of Miner Slough and Prospect Island from State Route 84 (Including Portion of the Hall Property)

Figure 3.11-4. View of Prospect Island from Arrowhead Harbor Marina

Legal and regulatory setting

State regulations

Unless otherwise noted, the Proposed Project would comply with the following state regulations.

State Scenic Highway System

State Route (SR) 84 is the primary highway accessing Prospect Island. This route is part of the California Freeway and Expressway System. SR 84 is eligible for the State Scenic Highway System and is classified as scenic for a section in Alameda County, but it has not been designated as a scenic highway in the Prospect Island vicinity (highway segment that runs from the Sacramento-San Joaquin Delta at Rio Vista to the Yolo County line).

Delta Plan

The Delta Plan notes that state and federal projects (water facilities, ecosystem restoration, or flood management) are not required to secure local agency or Delta Protection Commission approvals, but nevertheless should avoid conflicts with existing and planned land uses when feasible given that these projects can alter scenic views and create other concerns (Delta Stewardship Council 2013). Further, Delta Plan Recommendation 14 (R14) to “Enhance Nature-based Recreation” puts forth that the California Department of Fish and Wildlife, in cooperation with other public agencies, should collaborate with nonprofits, private landowners, and business partners to expand wildlife viewing, angling and hunting opportunities (Delta Stewardship Council 2013).

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local ordinances.

The Scenic Resources section of the Solano County General Plan (Solano County Board of Supervisors 2008) focuses on protecting the aesthetic qualities of the county's landscape. Policies and programs contained in the section aim to protect valued landscape features and ensure that new urban or rural development within scenic roadway corridors respects and maintains the integrity of viewsheds. The General Plan includes policies to strengthen the protection of the Tri-City and County Cooperative Plan area, protect ridgelines, reduce light pollution, and encourage the provision of scenic open spaces. The General Plan emphasizes the protection of scenic and natural resources, whether or not they are within view of a designated scenic highway. Prospect Island scenic open spaces would not be significantly altered so the threat to scenic resources as defined in the Solano County General Plan is negligible. The Solano County General Plan's Scenic Resources policies follow below.

Related plans, programs, and agencies

County area and specific plans contain language aimed at preserving, conserving, and enhancing visual resource values within the target planning area. The plans identify viewsheds or general scenic resources to be protected or improved. Plans that discuss visual resource protection explicitly include the Tri-City and County Cooperative Plan for Agriculture and Open Space Preservation. One of the primary objectives of the Tri-City and County Cooperative Plan is to conserve and enhance visual resources within the plan area.

Scenic resource policies

RS.P-35: Protect the unique scenic features of Solano County, particularly hills, ridgelines, wetlands, and water bodies.

RS.P-36: Support and encourage practices that reduce light pollution and preserve views of the night sky.

RS.P-37: Protect the visual character of designated scenic roadways. (Solano County Board of Supervisors 2008)

3.11.2 Significance criteria

Criteria for determining significant impacts are based upon the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that the Proposed Project would have a significant impact on visual quality if it would:

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

3.11.3 Impacts and mitigation

Impact 3.11-1: Temporary change in views during construction

Views from SR 84, Arrowhead Harbor Marina, and nearby waterways may be affected as a result of construction activities. The site would look different during construction due to the site being dewatered and earth-moving activities. During the construction period, visual character of the interior of the site would change from open water and marshes to bare earth with construction activities and equipment. However, most views of the interior of the site, except from a privately owned parcel located along the Miner Slough levee, would continue to be buffered by the vegetated levees. Construction would occur during daytime hours without the need for artificial lighting and would be completed over a several year period. Given that the construction activities would be temporary and not prominent from most viewpoints, this impact would be less than significant.

Impact significance
Less than significant

Impact 3.11-2: Long-term change in views from State Route 84

Prospect Island Tidal Marsh area is visible to drivers on SR 84. The primary aesthetic change from the Proposed Project would be expanded views of open water through the breaches, and the loss of views of the vegetated levee at the breach locations. Views of the interior of the Island also would change with tide stages. At high tide, views from the highway would show primarily open water in the center of the island or in the levee. At low tide, these viewers may see more marshy areas. However, most views of the interior of the site would continue to be mostly blocked by the vegetated levees.

Impact significance

Less than significant

Impact 3.11-3: Long-term change in views from Arrowhead Harbor Marina

Portions of Prospect Island also are visible from the Arrowhead Harbor Marina, by boaters/visitors and staff. Depending on its final location, the northern breach may be visible from the Marina. This breach would remove some of the existing riparian vegetation in views from the Marina and replace that view with open views onto the interior of the Island. The aesthetic impact of the Proposed Project would not be adverse because the only change for these viewers would be vistas with more open water and marsh vegetation through the breaches.

Impact significance

Less than significant

Impact 3.11-4: Long-term change in views from boats in Miner Slough

Prospect Island Tidal Marsh area is also visible by boaters in the Miner Slough. The only aesthetic change resulting from the Proposed Project for these viewers would be a view of slightly more open water and more expansive views of the interior of the Island through the breaches. At high tide, the Proposed Project would provide boaters with views through the breaches of slightly more open water. At low tide, boaters’ views may include more marshy areas. The impact from the Proposed Project would not be adverse because these aesthetic changes would be only marginally different from current views.

Impact significance

Less than significant

Impact 3.11-5: Long-term change in views from boats in the Deep Water Ship Channel

Prospect Island is also visible by boaters in the DWSC. Because no breaching of the ship channel levee would occur, and because most boaters would not be able to see the interior of the Island from their craft (except for large ships, which would afford views elevated over the levee), there would be no change in views for most viewers in the channel. The impact would be minimal and not adverse.

Impact significance
Less than significant

Impact 3.11-6: Long-term change in views from nearby residences

Portions of the levee and marsh interior are visible from the privately owned parcel adjacent to Miner Slough in the central part of the north property. The current view of Miner Slough from this parcel would remain similar and would not be adversely impacted. With the Proposed Project, the only aesthetic change would be elimination of portions of the vegetated levee from the breaches. Views of the interior of the Island may include more variation from open water to tidal wetlands, compared to the primarily open water views currently experienced. Views from other nearby residences, including those on Ryer Island, would not be affected by the Proposed Project. Thus, the impact on the residents of Prospect Island would not be adverse.

Impact significance
Less than significant

Impact 3.11-7: Long-term light and glare

The Proposed Project would not create a new source of substantial light or glare in the area because no lighting is proposed during or after construction and the major water areas would remain similar to existing conditions.

Impact significance
No impact

3.12 Agricultural Resources

This section describes agricultural resources on and near the Project site, and assesses the impacts of the Proposed Project on any such resources. Agricultural resource issues addressed include conversion of agricultural lands to other uses, impacts to Williamson Act properties, and other possible effects to agricultural resources on or off the site. Forestry resources are not evaluated because there are no forest resources on the site. Loss of mature trees on the levees is evaluated from a biological perspective in the Wetland and Terrestrial Biological

Resources (Section 3.4 Wetland and Terrestrial Biological Resources). This analysis is based on a December 2013 field reconnaissance and a review of applicable plans and policies.

3.12.1 Setting

Agricultural lands on and near the project site

The current land use at the Project site is open space/wildlife habitat. Surrounding land uses are agriculture and wildlife habitat.

Prior to 1995, Prospect Island was in agricultural use. In 1994, approximately 380 ac of wheat, 586 ac of field corn, and 184 ac of safflower were grown on the site. About the same proportions of these crops were rotated annually, but may have included about 100 ac of sugar beets in some years. Processing tomatoes and Sudan grass were also grown in some years. A small portion of land at the site was used for machinery paths and irrigation ditches. An unscreened diversion withdrew several thousand acre-feet of water to support the crops (USACE and DWR 2001).

The Project site flooded in March 1995 due to breaks in the south Miner Slough levee and the cross levee separating it from the Port's property. The breaches in the cross levee and the Miner Slough levee were repaired, and the DWR property (then owned by the Bureau of Reclamation) was pumped dry in July 1996. In January 1997, the island flooded when the levees breached again. Repair of the Miner Slough levee breach was completed in November 1998, and repair of the cross levee was completed in January 1999. The levees breached again in 2006, including a failure of the internal cross levee. These levee failures were eventually repaired, but lands remained flooded for extended periods following each breaching event before the island was again pumped dry. Farming operations have not resumed in the area since March 1995. With the exception of farming activities that have occurred on a 17.7 ac of land north of the northern cross levee, Prospect Island has been fully or partially submerged and unusable for agricultural purposes for approximately 20 years.

CEQA Guidelines (Section 15125(a)) and case law state that the baseline for EIR review is existing conditions on the ground at the time that the NOP is issued[12]. Therefore, with the exception of farming activities that have occurred on 17.7 ac north of the northern cross levee (6.8 ac of DWR land and 10.9 ac of the adjacent

[12] The California Supreme Court clarified the CEQA baseline issue in its Neighbors for Smart Rail v. Exposition Metro Line Construction Authority (2013) 57 Cal.4th 439.

Fahn property), the Project site is not considered to be viable agricultural lands for the purposes of CEQA analysis.

Prospect Island as a whole is not designated as agricultural land in the California Department of Conservation's "Important Farmland" map for Solano County (California Department of Conservation 2012). Instead, Prospect Island is designated as "Other Land", reflecting flooded conditions and its current use as wildlife habitat. "Other Land" is defined by the California Department of Conservation as land not included in any other mapping category. Common examples include low density rural developments; brush, timber, wetland, and riparian areas not suitable for livestock grazing; confined livestock, poultry or aquaculture facilities; strip mines, borrow pits; and water bodies smaller than 40 ac.

Adjacent farmlands to the south and east of the Project site (i.e., Ryer Island) are designated as Prime Farmland (California Department of Conservation 2012). Prime Farmland is defined as "farmland with the best combination of physical and chemical features able to sustain long term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date." Although it is in agricultural use, the 17.7 ac of existing agricultural land north of the northern cross levee is not mapped as Prime, Unique, or Important Farmland.

According to a 2013 California Supreme Court decision (Neighbors for Smart Rail v. Exposition Metro Line Construction Authority (2013) 57 Cal.4th 439), CEQA considers the setting to be existing conditions unless use of those conditions would deprive the public and decision makers of important information or otherwise mislead them. Therefore, this EIR considers the agricultural setting to be the existing non-agricultural use of the Project site, as reflected in its "Other Land" designation in the County Agricultural Element, which is based on California Department of Conservation mapping.

Legal and regulatory setting

State laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

Williamson Act

The California Land Conservation Act of 1965 (referred to as the Williamson Act) allows local governments to create agricultural preserves and enter into contracts with private property owners to protect land for agricultural and open space purposes. This voluntary program offers preferential tax rates that assess lands based on actual use (agricultural or open space) as opposed to their Proposition 13 determined value, usually creating a financial incentive to maintain farmland and open space, as opposed to allowing conversion to other uses. The Williamson Act program uses rolling 10-year contracts that renew annually until either party files a “notice of non-renewal.” If an owner decides to opt out, the land is still protected for 10 years while the tax liability increases in annual increments up to its full market value. While most adjacent farmlands to the east and south are under Williamson Act contracts, the Project site is not (Solano County Board of Supervisors 2008, Figure AG-2, Williamson Act Contracts).

Delta Protection Commission’s Land Use and Resource Management Plan

The goal of the Delta Protection Commission (DPC) is to ensure orderly, balanced conservation and development of Delta land resources, including agriculture, wildlife habitat, and recreational activities, and improved flood protection. As called for in the Delta Protection Act, a LURMP for the Primary Zone of the Delta was prepared and adopted by the DPC in 1995 and revised in 2002 and 2010. The Management Plan outlines the long-term land use requirements for the Primary Zone of the Sacramento-San Joaquin Delta, which includes Prospect Island.

The LURMP promotes the maintenance of Delta agriculture and notes that the continued viability of agriculture in the Delta would require the protection of sufficient farmland and fresh water to support commercially viable operations and provide ways for agriculture to coexist with habitat restoration. Farming in the Delta would have to respond to changing conditions and new challenges in the coming years. Among these challenges are shifting commodity markets and consumer demand, changes in climate and water supplies, and subsidence of reclaimed agricultural lands. To support both Delta agriculture and species recovery, farmers in the Delta are encouraged to implement “wildlife-friendly” management practices to maximize habitat value. Relevant agricultural policies of the LURMP include:

> P-1: Support and encourage agriculture in the Delta as a key element in the state’s economy and in providing the food supply needed to sustain the increasing population of the state, the nation, and the world.

P-2: Conversion of land to non-agriculturally-oriented uses should occur first where productivity and agricultural values are lowest.

P-6: Encourage acquisition of agricultural conservation easements from willing sellers as mitigation for projects within each county. Promote use of environmental mitigation in agricultural areas only when it is consistent and compatible with ongoing agricultural operations and when developed in appropriate locations designated on a countywide or Delta-wide habitat management plan.

P-7: Encourage management of agricultural lands, which maximize wildlife habitat seasonally and year-round, through techniques such as fall and winter flooding, leaving crop residue, creation of mosaic of small grains and flooded areas, wildlife friendly farming, controlling predators, controlling poaching, controlling public access, and others.

P-8: Encourage the protection of agricultural areas, recreational resources and sensitive biological habitats, and the reclamation of those areas from the destruction caused by inundation.

Delta Plan

In November 2009, the California Legislature enacted SB 1 X7, also known as the Sacramento–San Joaquin Delta Reform Act. The Act and related legislation on Delta activities contemplates that these activities would involve the conversion of agricultural land to other uses and requires consideration of the agricultural values of the Delta. The Delta bill created a new Delta Stewardship Council (DSC) and gave this body broad oversight of Delta planning and resource management. The DSC adopted a long-term plan (the “Delta Plan”) in 2013. The Delta Plan sets forth regulatory policies and recommendations. With respect to agricultural uses, the Delta Plan states that the continued viability of agriculture in the Delta would require the protection of sufficient farmland and fresh water to support commercially viable operations and provide ways for agriculture to coexist with habitat restoration. To support both Delta agriculture and species recovery, farmers in the Delta are encouraged to implement “wildlife-friendly” management practices to maximize habitat value. The Delta Plan includes the following applicable policy:

DP R10: Encourage Wildlife-friendly Farming. The California Department of Fish and Wildlife, the Delta Conservancy, and other ecosystem restoration agencies should encourage habitat enhancement and wildlife-friendly farming systems on agricultural lands to benefit both the environment and agriculture (Delta Stewardship Council 2013).

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local policies.

Solano County General Plan

Prospect Island and the surrounding area are designated in the Solano County General Plan Land Use Element as Agriculture with a Resource Conservation Overlay (Solano County Board of Supervisors 2008). The Agriculture designation provides areas for the practice of agriculture as the primary use, including areas that contribute significantly to the local agricultural economy, and allows for secondary uses that support the economic viability of agriculture. Agricultural land use designations protect these areas from intrusion by nonagricultural uses and other uses that do not directly support the economic viability of agriculture. The Resource Conservation overlay identifies and protects areas of the county with special resource management needs. This designation recognizes the presence of certain important natural resources in the county while maintaining the validity of underlying land use designations. The overlay protects resources by: (1) requiring study of potential effects if development is proposed in these locations, and (2) providing mitigation to support urban development in cities. Resources to be protected through this overlay are those identified through technical studies as the highest priority areas within the habitat conservation planning process. Conservation measures used to achieve the County's resource goals vary based on the targeted resource. As discussed above, the Prospect Island site is designated as Other Lands and has not been in agricultural use for about 20 years.

Prospect Island is in the Ryer Island Agricultural Region (RIAR), as designated by the Solano County General Plan (Solano County Board of Supervisors 2008). The RIAR is located in the southeastern-most corner of the county and is characterized by fertile soils and little development. Farmers in the area produce primarily field crops that are tolerant of spring flooding. Some producers have planted wine grapes and orchards as well. The RIAR is isolated from major transportation corridors and access to Region is provided only by a narrow bridge or by ferry. Most of the crops grown on the RIAR are transported to and processed in San Joaquin, Sacramento, and Yolo Counties.

The goals and policies of the General Plan Agricultural Element are intended to provide a framework for achieving the agricultural vision. Applicable goals include:

> AR.G-1: Recognize, value, and support the critical roles of all agricultural lands in the stability and economic well-being of the county.
>
> AR.G-2: Preserve and protect the county's agricultural lands as irreplaceable resources for present and future generations.
>
> AR.G-3: Support the ability of farmers to earn sufficient income and expand the county's agricultural base by allowing for a wide range of economic activities that support local agriculture.
>
> AR.G-5: Reduce conflict between agricultural and nonagricultural uses in Agriculture-designated areas.
>
> AR.G-6: Recognize, support, and sustain agricultural water resources for farmlands.

Applicable policies include:

> AG.P-8: Maintain water resource quality and quantity for the irrigation of productive farmland so as to prevent the loss of agriculture related to competition from urban water consumption internal or external to the county.
>
> AG.P-9: Promote efficient management and use of agricultural water resources.
>
> AG.P-25: Facilitate partnerships between agricultural operations and habitat conservation efforts to create mutually beneficial outcomes. Although such partnerships are to be encouraged throughout the county, additional emphasis should be focused in locations where the Resource Conservation Overlay and Agricultural Reserve Overlay coincide.
>
> AG.P-35: Lands within the Agriculture designations may be re-designated to Watershed or Marsh.

Right-to-Farm Ordinance

Chapter 2.2 of the Solano County Code protects farm operations from nuisance complaints associated with residential uses located next to active agricultural operations. These complaints often cause farm operators to cease or curtail operations. They may also deter others from investing in farm-related improvements that would support the county's agriculture economy. This "right-to-farm ordinance", as it is commonly known, guarantees the right to continue agricultural operations, including, but not limited to, cultivating and tilling the soil, burning agricultural byproducts, irrigating, raising crops and/or livestock, and applying approved chemicals in a proper manner to fields and farmland. This ordinance limits the circumstances under which agriculture may be considered a nuisance. To prevent future conflicts, notice of this ordinance is given to purchasers of real property in the county.

3.12.2 Significance criteria

Criteria for determining significant impacts are based upon the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that a project would have a potentially significant impact on agricultural resources if it would:

- Convert a substantial amount of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Important Farmland), as shown on California Department of Conservation maps, to non-agricultural use.
- Conflict with existing zoning for agricultural use, or with a Williamson Act contract.
- Involve other changes in the existing environment that, due to their location or nature, could result in the conversion of farmland to non-agricultural uses.

The CEQA statute (PRC Section 21060.1[a]) defines Agricultural Land as "prime farmland, farmland of statewide importance, or unique farmland, as defined by the USDA land inventory and monitoring criteria as modified for California."

3.12.3 Impacts and mitigation

Impact 3.12-1: Loss or conversion of prime, unique, or important agricultural lands

With the exception of the 17.7 ac of existing agricultural land north of the northern cross levee, the Project site has not been in agricultural use for approximately 20 years and is mostly submerged. No portion of Prospect Island is designated as Prime, Unique or Important Agricultural Land. During construction activities, the

17.7 ac of existing agricultural land would be converted to a temporary staging area (Table 2.2-2 and Figure 2.2-1). Following construction activities, this area would be planted with a riparian mix containing both canopy and understory trees and shrubs, creating complex, high value riparian area. However, the conversion of 17.7 ac of agricultural land to riparian habitat would be less than significant because it does not represent conversion of Prime, Unique, or Important Agricultural Land and it would be only a very small portion of total local agricultural lands (<0.5%).

Impact significance

Less than significant

Impact 3.12-2: Conflicts with Williamson Act contracted lands

The Project site is not under a Williamson Act contract. Therefore, the Proposed Project would have no impact to any such contracted lands.

Impact significance

No impact

Impact 3.12-3: Potential effects to agricultural uses on adjacent lands

Adjacent lands to the south and east of the Project site are designated as Prime Farmland and are in active agricultural use. As described in Section 3.1 Hydrology, it is anticipated that the Proposed Project would not result in substantial seepage to nearby farmland on adjacent islands, therefore it would not significantly adversely affect agricultural uses on those lands.

Impact significance

Less than significant

3.13 Cultural Resources

This section describes the cultural resources present in the Proposed Project area and assesses impacts to those cultural resources. Cultural resources are defined as: all “built environment” resources (structures, levees, etc.), culturally important resources (sacred places and locations associated with traditional activities), and archaeological resources (both prehistoric and historic). The analysis is based on multiple cultural resource inventories and assessments, including literature review, field surveys on land and in the water, archival research, and Native American and historical society consultation. The study methods, findings, and results are summarized below by resource type. Paleontological resources also are considered in this section.

3.13.1 Setting

Environmental setting

Prospect Island is located in the northern Delta. The Official Map of Solano County 1877 depicts the island as un-parceled marshland bordered on the north and west by Prospect Slough and on the east by Miner Slough. By 1915, The Official Map of Solano County depicts the southern three quarters of the island owned by the Anita Land Company and the northern portion owned by Schwan and Deming. Reclamation District 1667 was formed on Prospect Island on January 4, 1917 by the Anita Land Company. The levees were built at that time and farming began by the Prospect Farms Company. Prospect Island has been used for the production of beans, sugar beets, onions, hay, milo, and corn. In the mid-1990s, after the island passed into federal ownership, farming on the island ended.

Literature review

A literature search and an update for the Proposed Project area were conducted by the staff of the Northwest Information Center (NWIC) of the California Historical Resources Information System, Sonoma State University on March 20, 2012 and on September 30, 2013. The searches encompassed a ¼-mile radius around the Proposed Project area.

References consulted include:

- *California Inventory of Historic Resources* (DPR 1976)
- Office of Historic Preservation *Archaeological Determinations of Eligibility* (OHP 2012a)
- Office of Historic Preservation *Historic Property Directory* (OHP 2012b) (which includes listings of the California Register of Historical Resources, California State Historical Landmarks, California State Points of Historical Interest and the National Register of Historic Places)

Archaeological resources

Based on the literature review, no prehistoric or historic-era archaeological sites are known to occur in the Proposed Project area. Four cultural resource surveys have been conducted on Prospect Island, three covering a small portion of the Proposed Project area (Welch 1998; Welch 2007; Bruce 2008), and one covering the entire island (Parus Consulting 2012). The three smaller studies consisted of pedestrian surveys of portions of the Proposed Project area. The large island-wide survey included a pedestrian survey of the accessible dry-land portions of the Proposed Project area using standard transect spacing no greater than 49 ft apart and a kayak survey of the areas that were inaccessible by foot. Much of the island was inundated during the recent island-wide study. No prehistoric archaeological resources were identified in the four cultural resource surveys.

Native American consultation

The Native American Heritage Commission (NAHC) was contacted by Parus Consulting on March 12, 2012 for a Sacred Lands File search and a Native American contact list. The reply from the NAHC, dated March 22, 2012, stated that the search failed to indicate the presence of Native American Sacred lands or traditional cultural properties in the immediate Proposed Project vicinity. Notification letters were sent to tribes and interested members of the public. No responses were received (Appendix B in Parus Consulting 2012).

Historical resources

Structures

Historic-era structures recorded within the Proposed Project area include the Prospect Island levee system (P-48-000787), a group of six buildings and outbuildings called the “Prospect Island Houses” (P-48-000417), and a house designated Parus-1H-12 (P-48-000956). The Prospect Island houses (P-48-000417) consist of three buildings and three associated outbuildings that were recorded in 1997 (Welch 1998): the Ferry Operator House, a single story house, a two story bunkhouse for farm labor, a pump house, a wash house, and a collapsed structure.

These structures were evaluated for historical significance and determined by the State Historic Preservation Officer to be ineligible for listing on the Natural Register of Historic Places (NRHP) on March 9, 1998 (OHP Project Reference No. BUR980123A) and the levee was likewise determined ineligible on July 7, 2008 (OHP Project Reference No. BUR080627B). Of the “Prospect Island Houses”, only the pump house was relocated during the 2012 survey by Parus Consulting (Parus Consulting 2012). The levee remains intact, but is not considered an historical property under NHPA or a historical resource under CEQA. The previously unrecorded structure (Parus-1H-12) and the previously recorded and evaluated pump house (P-48-000417) were recorded and evaluated by Parus Consulting (2012) and recommended ineligible for NRHP and California Register of Historical Resources (CRHR) listing. They currently remain intact on the island.

Shipwrecks

DWR requested a California State Lands Commission (CSLC) shipwreck query on August 27, 2013, because the Proposed Project could have in-water effects. The CSLC Shipwreck Database search returned two possible wrecks in the Proposed Project area, a steamer *Zinfandel* that sunk in 1922 and the gold rush-era schooner, *Goliah*. A series of steps were taken to identify whether and where the ships resided within the Proposed Project area. These steps included research of digital newspaper collections, archival research, historical society consultation, and a shipwreck survey (Parus Consulting 2014).

Archival and internet research led to the conclusion that *Goliah* is most likely located in Steamboat Slough near the confluence with Cache Slough, and not in the Proposed Project area. Conversely, research confirmed that the *Zinfandel* went down in 1922 in Miner Slough, although the exact location was not recorded. Archival research and historical society consultation did not provide precise locational data on the wreck or whether the wreck was salvaged, therefore a shipwreck survey in Miner Slough adjacent to the Proposed Project area was performed. The shipwreck survey used side-scan sonar and magnetometer readings to locate the ship's remains. The *Zinfandel* was not located in Miner Slough adjacent to the Proposed Project area (Parus Consulting 2014).

Paleontological resources

The Project site is located in Holocene-aged sediments, which formed after the end of the last glacial maximum (URS 2013). Holocene sediments are recent, less than 11,000 years old, and are not considered to contain paleontological resources. Proposed Project activities would not extend beyond the Holocene geologic units and into older sediments. Thus, there is no possibility of the presence of paleontological resources.

Legal and regulatory setting

Multiple state and federal laws govern the treatment of cultural resources. Both CEQA and PRC 5024 apply to state owned resources and state sponsored projects. Because the Proposed Project includes actions that involve issuance of federal permits, there is a federal nexus and compliance with the National Historic Preservation Act (NHPA) and its implementing regulations (36 Code of Federal Regulations [CFR] 800, 36 CFR 60, and 36 CFR 63) is required.

Federal laws

Unless otherwise noted, the Proposed Project would comply with the following federal laws.

National Historic Preservation Act Section 106 and guidelines

The NHPA of 1966, as amended, sets forth national policy and procedures for historic properties, defined as districts, sites, buildings, structures, and objects included in or eligible for listing in the NRHP. Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties and to allow the Advisory Council on Historic Preservation the opportunity to comment on those undertakings, following regulations issued by the Council (36 CFR 800).

Under Section 106, cultural resource significance is evaluated in terms of eligibility for listing in the NRHP. The NRHP criteria for evaluation are defined at 36 CFR 60.4 as follows: The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and meet the following:

- Are associated with events that have made a contribution to the broad pattern of our history;
- Are associated with the lives of people significant in our past;
- Embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or,
- Have yielded, or are likely to yield, information important in prehistory or history (36 CFR 60.4).

If historic properties are identified in the Proposed Project area, effects of the Proposed Project on those properties must be assessed. If effects would be adverse, the federal agency would continue working with the consulting parties to resolve the adverse effects through Proposed Project modifications, avoidance, minimization, or mitigation (36 CFR 800.5-800.6).

State laws

Unless otherwise noted, the Proposed Project would comply with the following state laws.

California Environmental Quality Act—statute and guidelines

The CEQA requires that public agencies that finance or approve public or private projects must assess the effects of the Proposed Project on cultural resources (CEQA Guidelines Section15064.5). “Cultural resource” is a general term that encompasses CEQA's definition of historical resources (PRC Section21084.1) and unique archaeological resources (PRC Section21083.2). CEQA requires that alternative plans or mitigation measures must be considered if a project would result in significant effects on important cultural resources. Only significant cultural resources, however; need to be addressed (CEQA Guidelines 15064.5 [a][3]). Therefore, prior to the development of mitigation measures, the significance of cultural resources with the potential to be impacted by the Proposed Project must be determined. The criteria for determining historical significance are defined in PRC 5024.1.

CEQA Guidelines also require that a lead agency make provisions for the accidental discovery of historical or archaeological resources. Pursuant to Section 15064.5, subdivision (f), these provisions should include "an immediate evaluation of the find by a qualified archaeologist. If the find is determined to be an historical or unique archaeological resource, contingency funding and a time allotment sufficient to allow for implementation of avoidance measures or appropriate mitigation should be available. Work could continue on other parts of the building site while historical or unique archaeological resource mitigation takes place."

California Public Resources Code Sections 5024

PRC Section 5024.1 establishes the California Register of Historical Resources, which is the authoritative guide for identifying the state's historical resources to indicate what properties are to be protected, if feasible, from substantial adverse change.

In order for a resource to be eligible for the CRHR it must be over 50 years old, retain its historic integrity, and satisfy one or more of the following criteria:

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

Discoveries of Human Remains under California Health and Safety Code Section 7050.5 (b-c) and Public Resources Code Section 5097.98 (a)

In the event of discovering human remains, there shall be no further excavation or disturbance of the remains until they are examined by the Solano County

Coroner. The Coroner has two working days to determine the nature of those remains. If the Coroner determines that the remains are Native American, he/she would contact the Native American Heritage Commission (NAHC) by telephone within 24 hours.

Once the NAHC has been notified of the discovery of Native American human remains, it shall immediately notify those persons believed to be the most likely descendants. The most likely descendants may inspect the site of the discovery and recommend to the owner methods of treating, with dignity, the human remains and any associated grave goods. The descendants shall complete their inspection and make recommendations or preferences for treatment within 48 hours of being granted access to the site.

3.13.2 Significance criteria

Under CEQA CCR Section 15064.5 and Appendix G of the *State CEQA Guidelines*, the Proposed Project would have a significant impact on archaeological or historical resources if it would result in any of the following threshold criteria:

- A substantial adverse change in the significance of an historical resource as defined in CCR Section 15064.5.
- A substantial adverse change in the significance of an archaeological resource as defined in CCR Section 15064.5.
- Disturb human remains, including remains interred outside of established cemeteries. For the purposes of this analysis disturbance may consist of direct excavation or damage through compaction even where the resource is not directly excavated.
- Under Section 106 of the NHPA, an adverse effect on an historic property is found when an activity may alter, directly or indirectly, any of the characteristics of an historic property that qualify it for inclusion in the NRHP. The alteration of characteristics is considered adverse if it may diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association.

3.13.3 Impacts and mitigation

Impact 3.13-1: Impacts to historical resources on land

The Proposed Project would entail the demolition of existing buildings/structures on the island, and would include breaching the levee in two places. As mentioned above, previously recorded cultural resources at the Project site (i.e., Prospect

Island levee system, Prospect Island houses, and the one other structure) were evaluated for historical significance and found not eligible for listing on the NRHP or the CRHR (Welch 1998; Bruce 2008; Parus Consulting 2012; SHPO reference No. BUR080627B). All but two of these buildings and the levees were demolished prior to 2012. The pump house and the house found during the 2012 survey are still standing and the levee is still intact. Both the levee and the extant buildings have been determined by the State Historic Preservation Officer to be historically insignificant and ineligible for listing on the NRHP and CRHR (SHPO reference No. COE-2014-0701-001). Since these remaining buildings and levees do not qualify as historical resources, no impact would occur as a result of their demolition for the Proposed Project.

Impact significance

No impact

Impact 3.13-2: Inadvertent discovery of a shipwreck during in-water construction

The shipwreck survey did not find the steamship *Zinfandel* in Miner Slough adjacent to the Project site (Parus Consulting 2014). Although a magnetometer and sidescan sonar survey covered the levee breach locations, it is possible that an unrecorded shipwreck may be buried in sediment in the Miner Slough channel and could be encountered during clamshell dredging. If an unknown shipwreck is discovered during the construction phase, then a potentially significant impact could occur. Implementation of Mitigation Measure 3.13-2.1 would reduce this impact to less than significant.

Mitigation Measure 3.13-2.1

The title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the state and under the jurisdiction of the CSLC (PRC Section 6313[a]). In the case of an inadvertent discovery of a submerged shipwreck or related artifacts, all work must cease in the immediate vicinity of the find and DWR cultural resources staff and the USACE archaeologist shall be notified immediately in order to initiate consultation with the CSLC staff within 2 business days of such discovery pursuant to 36 CFR 800.13 (b)(3).

PRC 6313 (c) states any submerged historic resource remaining in state waters for more than 50 years shall be presumed to be archaeologically or historically significant. If the DWR and USACE archaeologist, in consultation with the CSLC staff, determine that a historical resource may be present within the Project site, DWR shall retain the services of a qualified maritime archaeological consultant.

The maritime archaeological consultant would recommend whether the discovery is an historical/archaeological resource that retains sufficient integrity and is of potential historical or scientific significance. The maritime archaeological consultant also would recommend as to what action, if any, is warranted and would document all recommendations in writing. Based on this information, the USACE, in consultation with the CSLC, may require additional measures to be implemented by DWR.

Measures might include preservation *in situ* of the historical resource or a data recovery program. The Proposed Project maritime archaeological consultant shall submit a Final Historical Resources Report to DWR, the USACE, and the CSLC staff. This report shall include an evaluation of the historical significance, with a description of the archaeological and historical research methods employed in any archaeological data recovery program undertaken.

Impact significance

Less than significant with mitigation

Impact 3.13-3: Impacts to unknown archaeological resources

No known prehistoric or historic-era archaeological resources meeting CRHR or NRHP eligibility criteria were previously recorded inside the Proposed Project area or found during archaeological surveys conducted at the Project site. However, excavation of channels and earth working activities during construction have the potential to impact unrecorded cultural resources. Should cultural resources be encountered during ground-disturbing activities during the construction and post-construction phases, then a potentially significant impact could occur. Implementation of Mitigation Measure 3.13-3.1 would reduce this impact to less than significant.

Mitigation Measure 3.13-3.1

The following mitigation measure shall be implemented before the start of ground-disturbing activities.

1. A DWR archaeologist shall conduct cultural resources awareness training for contractors and staff prior to the start of construction.
2. If historical or unique archaeological resources are discovered during construction, work must be halted within 100 ft of the find until a qualified archaeologist meeting the Secretary of the Interior's Standards for archaeologists (NPS 1997) visits the site and assess the significance of the resource. Work may continue on other parts of the Proposed Project while evaluation and mitigation takes place (CEQA Guidelines Section15064.5 [f]).

After the assessment is completed, the archaeologist shall submit a report describing the significance of the discovery with treatment recommendations. If the find is determined to be an historical or unique archaeological resource, time allotment and funding sufficient to allow for implementation of avoidance measures or appropriate mitigation must be available.

3. Should unique archaeological resources be found, the resources shall be treated in compliance with Public Resources Code Section 21083.2. If the Proposed Project can be modified to accommodate avoidance, preservation of the resource is the preferred alternative. Data recovery of the damaged portion of the resource also shall be performed pursuant to PRC Section 21083.2(d).

Impact significance

Less than significant with mitigation

Impact 3.13-4: Impacts to unknown human burials

No human remains or archaeological contexts have been identified in the Proposed Project area and it is unlikely that human remains would be encountered during construction activities. However, the potential to unearth human remains during construction still exists. Ground disturbing activities have the potential to result in the discovery or inadvertent damage of human remains and this possibility cannot be completely eliminated, therefore a potential for significant impact remains. Implementation of Mitigation Measure 3.13-4.1 would reduce the potential impacts to less than significant.

Mitigation Measure 3.13-4.1

If human remains are found, such remains are subject to the provisions of California HSC Section 7050.5-7055. The requirements and procedures shall be implemented, including immediately stopping work in the vicinity of the find and notification of the Solano County Coroner. The process for notification of the California NAHC and consultation with the individual(s) identified by the NAHC as the “most likely descendant” is set forth in Section 5097.98 of the California Public Resources Code. Work can restart after the remains have been investigated and appropriate recommendations have been made for the treatment and disposition of the remains.

Impact significance

Less than significant with mitigation

Impact 3.13-5: Impacts to paleontological resources

Geological units bearing paleontological resources are not present on the island (URS 2013); therefore, there would be no impact to paleontological resources. No mitigation is required.

Impact significance

No impact

3.14 Land Use and Planning/Population and Housing

This section describes and assesses land use impacts, including housing and population, on and near the Project site. Actual land use is considered on and adjacent to the site. The analysis is based on field reconnaissance and review of applicable maps, plans, and policies.

3.14.1 Setting

Environmental setting

Prospect Island is located at the eastern edge of Solano County, in an area dominated by agricultural land uses. The Project site, including both the north and south properties, is currently flooded, uncultivated land that, prior to flooding, was used for agriculture (see Section 3.12 Agricultural Resources). Currently, the south property is leased out for waterfowl hunting year-round. There is only one potential residence on Prospect Island, located on a privately owned parcel adjacent to Miner Slough in the central part of the north property. There are no full-time residents on Prospect Island.

Nearby land uses

Sacramento Deep Water Ship Channel (DWSC)

The western edge of Prospect Island is bounded by the DWSC, a 45.8-mile long navigation channel managed by the Port that runs from the confluence of the Sacramento and San Joaquin rivers in the western Delta, up the Sacramento River, through lower Cache Slough, and north to the Port. The DWSC runs through Contra Costa, Solano, Sacramento, and Yolo counties and serves the marine terminal facilities of the Port. The most common cargo transported by ships using the DWSC are products related to the agricultural industry, with rice now comprising 96% of the total cargo tonnage (City of West Sacramento 2013).

Liberty Island

Liberty Island, which is approximately 4,525 ac, is located on the western side of the DWSC. The levees protecting the island failed during the El Niño floods of 1998, and they were never repaired. Prior to the levee breach, Liberty Island was used primarily for agricultural production. Since the breach, Liberty Island has served as flooded open space supporting fish populations and wetlands habitat. In January 2011, the Trust for Public Land transferred 4,308 ac of Liberty Island to the California Department of Fish and Wildlife (CDFW), for ongoing restoration and protection. The Liberty Island Conservation Bank, owned by Wildlands, Inc, comprises the remaining northern 186 ac of Liberty Island, and functions as an on-going tidal restoration project (Reclamation District 2093 2009).

<u>Prospect Island West</u>

Completion of the DWSC in 1963 cut off the western section of Prospect Island, a sliver of land, from the main island. The levees were no longer maintained and subsequently failed in the early 1960s. These lands are now a combination of shallow tidal waters, tidal marsh, and riparian vegetation.

Miner Slough Wildlife Area

The Miner Slough Wildlife Area is located adjacent to the south end of Prospect Island and managed by CDFW. The Miner Slough Wildlife Area is a 37-ac tidal and riparian reserve composed of one small island and a narrow peninsula surrounded by waterways extending from Prospect Island.

Ryer Island

Ryer Island is to the east of Prospect Island across Miner Slough. The vast majority of Ryer Island is actively farmed. Ryer Island includes the Snug Harbor Resort residential area (on the southeastern portion of the Island), a marina on the southern tip of the island, and a managed wetland near Miner Slough. The island supports a resident community of 200 people as well as 250–300 seasonal migrant workers. Ryer Island is managed by Reclamation District 501.

Hall Island

Hall Island is a privately owned island almost completely enclosed by Prospect Island on Miner Slough. The 21-ac property was once connected by a road to Prospect Island and supported multiple residences. The island flooded sometime between 1993 and 2002 and has since reverted mainly to open water with a fringe of tidal marsh and riparian vegetation. Although there is an access easement that follows the Prospect Island levees along the DWSC and perimeter of the south property, there is currently no land access between Hall Island and the Prospect Island levees (Figure 2.1-2).

Stringer Property

A 9-ac, privately owned parcel of land is connected to the central part of the north property adjacent to Miner Slough. Most of the small parcel has flooded and reverted to a mixture of open water, tidal marsh, and riparian vegetation. There is a dilapidated house, which has been unoccupied, located towards the northeast corner of the property along Miner Slough. (Figure 2.1-2). The Proposed Project would require provision of an alternate access to this property, or acquisition of the existing easement. (Figure 2.1-2).

Arrowhead Harbor Marina

Arrowhead Harbor Marina is located just north of Prospect Island across Miner Slough, at the southwestern tip of the Clarksburg Agricultural District. This 5-ac marina is the closest marina to the Project site, and the only one currently operational on Miner Slough.

Little Holland Tract and Little Holland Tract East

A remnant of Little Holland Tract lies directly to the north of Prospect Island and is separated from Prospect Island by a restricted-height levee. Little Holland Tract was split into two pieces by construction of the DWSC. The levees around Little Holland Tract on the west side of the DWSC breached in 1983, were repaired in 1991, and breached again in 1992. The USACE assumed management upon purchase of the tract in 1999. Little Holland Tract is now a mixture of tidal marsh, riparian vegetation, and shallow tidal waters. On the east side of the DWSC, north of Prospect Island, lies Little Holland Tract East. This 600-ac privately owned parcel remains in agricultural production.

Miner Slough

Recreational vessels use Miner Slough, including the two small side channels, for fishing and recreational boating.

Nearby Municipal Areas

The City of Rio Vista and the Rio Vista Municipal Airport are located approximately 3 miles southwest of Prospect Island. The largest major metropolitan area in the vicinity, Sacramento, is located 30 miles to the northeast.

Legal and regulatory setting

Federal laws and regulations

There are no federal laws or regulations regarding land use on Prospect Island. However, the site is in the Yolo Bypass, where development is limited to prevent floodplain restrictions and hazards to structures from flood flows.

State regulations

Unless otherwise noted, the Proposed Project would comply with the following state regulations.

Delta Land Use and Resource Management Plan (Delta Protection Commission)

The DPC was created by the State Legislature in 1992 with the goal of developing regional policies for the Delta to protect and enhance the existing land uses in the Primary Zone: agriculture, wildlife habitat, and recreation. A large portion of the Yolo Bypass Wildlife Area (YBWA) is within the Primary Zone of the Delta. The DPC's LURMP for the Primary Zone of the Delta (Delta Protection Commission 2010) includes the following policies and recommendations applicable to the land use:

- **Land Use Policy P-2:** Local government General Plans and zoning codes shall continue to strongly promote agriculture as the primary land use in the Primary Zone; recreation land uses shall be supported in appropriate locations and where the recreation uses do not conflict with agricultural land uses or other beneficial uses, such as waterside habitat.
- **Land Use Recommendation R-2:** Public agencies and non-profit groups have or propose to purchase thousands of acres of agricultural lands to restore to wildlife habitat. The amount, type, and location of land identified to be enhanced for wildlife habitat should be studied by wildlife experts to determine goals for future acquisition and restoration. Lands acquired for wildlife habitat should also be evaluated for recreation, access, research and other needed uses in the Delta. Habitat restoration projects should not adversely impact surrounding agricultural practices. Public-private partnerships in management of public lands should be encouraged. Public agencies shall provide funds to replace lost tax base when land is removed from private ownership.
- **Land Use Recommendation R-3:** Multiple use of agricultural lands for commercial agriculture, wildlife habitat, and, if appropriate, recreational use, should be supported, and funding to offset management costs pursued from all possible sources. Public agencies shall provide funds to replace lost tax base when land is removed from private ownership.

The Delta Plan (Delta Stewardship Council)

The Delta Plan is a comprehensive, long-term management plan for the Delta. Required by the 2009 Delta Reform Act, it creates new rules and recommendations to further the state's co-equal goals for the Delta: Improve statewide water supply reliability, and protect and restore a vibrant and healthy Delta ecosystem, all in a manner that preserves, protects and enhances the unique agricultural, cultural, and recreational characteristics of the Delta. The Delta Plan contains a set of regulatory policies that would be enforced by the Council's appellate authority and oversight. The Delta Plan designates the Project site as being in a Priority Habitat Restoration Area. Relevant Delta Plan policies include the following "recommended policies":

- **ER R2. Prioritize and Implement Projects that Restore Delta Habitat.** Bay Delta Conservation Plan implementers, California Department of Fish and Wildlife, California Department of Water Resources, and the Delta Conservancy should prioritize and implement habitat restoration projects in the areas shown on Figure 4-8 of the Delta Plan (Delta Stewardship Council 2013). Habitat restoration projects should ensure connections between areas being restored and existing habitat areas and other elements of the landscape needed for the full life cycle of the species that would benefit from the restoration project. Where possible, restoration projects should also emphasize the potential for improving water quality.
- **DP R10. Encourage Wildlife-friendly Farming.** CDFW, the Delta Conservancy, and other ecosystem restoration agencies should encourage habitat enhancement and wildlife-friendly farming systems on agricultural lands to benefit both the environment and agriculture.

Central Valley Flood Protection Board

Pursuant to CCR Title 23 Water Code, the CVFPB is responsible for enforcing standards for construction, maintenance, and protection of adopted flood control plans within the Central Valley of California, including the Yolo Bypass. An encroachment permit from the CVFPB is required for any project or plan of work that: (1) is within federal flood control project levees and within a CVFPB easement; (2) may have an effect on the flood control functions of project levees; (3) is within a CVFPB designated floodway; or (4) is within the regulated Central Valley streams listed in Table 8.1 of 23 CCR. The CVFPB exercises jurisdiction over the levee section, the waterward area between project levees, a 10-ft-wide strip adjacent to the landward levee toe, within 30 ft of the top of the banks of un-leveed project channels, and within designated floodways adopted by the CVFPB. Proposed restoration and levee work within the Proposed Project area would require an encroachment permit from the CVFPB.

23 CCR 107 provides for uses that may be permitted in a designated floodway, provided they would not unduly impede the free flow of water in the floodway or jeopardize public safety. Some of these uses that may apply to Proposed Project activities include: (a) open space uses not requiring a closed building, such as agricultural croplands, orchards, livestock feeding and grazing, or public and private recreation areas; (b) fences, fills, walls, or other appurtenances which do not create an obstruction or debris-catching obstacle to the passage of floodwaters; (f) improvements in stream channel alignment, cross-section, and capacity; and (i) other uses which are not appreciably damaged by floodwaters.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local policies.

Solano County General Plan—land use chapter

The Solano County General Plan designates both the north and south properties as intensive agriculture, a non-essential agricultural land-use designation, with a "Resource Conservation Overlay" (Solano County Board of Supervisors 2008). As described in Section 3.12 Agricultural Resources, the agriculture designation provides areas for the practice of agriculture as the primary use, including areas that contribute significantly to the local agricultural economy, and allows for secondary uses that support the economic viability of agriculture. Agricultural land use designations protect these areas from intrusion by nonagricultural uses and other uses that do not directly support the economic viability of agriculture.

The Resource Conservation overlay identifies and protects areas of the County with special resource management needs. This designation recognizes the presence of certain important natural resources in the county while maintaining the validity of underlying land use designations. The overlay protects resources by (1) requiring study of potential effects if development is proposed in these locations, and (2) providing mitigation to support urban development in cities. Resources to be protected through this overlay are those identified through technical studies as the highest priority areas within the habitat conservation planning process. Conservation measures used to achieve the County's resource goals vary based on the targeted resource.

The Land Use Chapter (Chapter 2) of the Solano County General Plan describes present and planned land uses and their relationship to the County's long-range goals for the future. It provides a framework for other issues examined in the General Plan and identifies how land is used throughout the county for agriculture, housing, business, community facilities, transportation, recreation, and open space.

Two applicable land use strategies are expressed in the General Plan vision statement:

- Promoting city-centered development consistent with longstanding County policy that "What is urban shall be municipal"; and,
- Sustaining diverse land uses that define the character and identity of Solano County.

Solano County General Plan—resources chapter

The Resources Chapter of the Solano County General Plan functions as the plan's Open Space Element. The purpose of the Resources Chapter is to identify the goals, policies, and implementation measures that would be used by the County in day-to-day decision making to protect natural, cultural, and open space resources. The chapter focuses on conserving, preserving, and enhancing these resources to ensure a high quality of life for current and future county residents. The Open Space Element is used to manage all open space areas, including undeveloped wilderness lands and outdoor recreation uses. The California Government Code defines that open space should be preserved for the preservation of natural resources, managed production of resources, recreation, and public health and safety.

The following policies of the Resources Chapter are applicable to the Project site:

- RS.G-1: Manage and preserve the diverse land, water, and air resources of the county for the use and enrichment of the lives of present and future generations.
- RS.G-2: Ensure continued presence and viability of the county's various natural resources.
- RS.G-3: Repair environmental degradation that has occurred, and seek an optimum balance between the economic and social benefits of the county's natural resources.

- RS.G-4: Preserve, conserve, and enhance valuable open space lands that provide wildlife habitat; conserve natural and visual resources; convey cultural identity; and improve public safety.
- RS.G-6: Preserve the visual character and identity of communities by maintaining open space areas between them.
- RS.G-10: Foster sound management of the land and water resources in Solano County's watersheds to minimize erosion and protect water quality using best management practices and protect downstream waterways and wetlands

Solano County zoning ordinance

The site is zoned A-80, which is intended exclusively for agriculture with an 80-ac-minimum lot size. (Solano County Zoning Map, 16-N, 7/26/77)

3.14.2 Significance criteria

Criteria for determining significant impacts are based upon the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that a project would have a potentially significant impact on land use and planning if it would:

- Physically divide an established community.
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Proposed Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.
- Conflict with any applicable habitat conservation plan or natural community conservation plan. This criterion is addressed in the biological resources sections and therefore is not evaluated in this section.

In addition, the following criterion is used to determine significant impacts on land use and planning if it would:

- Cause a substantial conflict with adjacent or nearby land uses.

3.14.3 Impacts and mitigation

Impact 3.14-1: Potential conflicts with adjacent land uses

The Proposed Project would not result in increased seepage of groundwater onto Ryer Island (impacts 3.1-6 and 3.12-3), and therefore would not be incompatible with agricultural uses in those areas. In addition, the Proposed Project would not result in navigational hazards for boats accessing the Arrowhead Harbor Marina (Impact 3.16-2).

However, the Proposed Project would eliminate access to a privately owned parcel connected to the northern portion of Prospect Island along Miner Slough, due to the interior cross levee excavation and northern Miner Slough breaches. This would result in potential conflicts with residential uses on that parcel. This would be a significant impact. Implementation of Mitigation Measure 3.17-2.1 would reduce this impact to less than significant.

The existing Hall property easement along the southern portion of the Miner Slough levee would be interrupted at the location of the southern breach of the Proposed Project. However, because there is currently no land access to Hall Island from the Miner Slough levee and the property is flooded, there would be no potential conflicts with existing land uses on the property.

Impact significance

Less than significant with mitigation

Impact 3.14-2: Potential conflict with plans and policies

The Proposed Project would not change existing land uses on the site nor conflict with the plans and policies discussed in setting section of this resource area. The Proposed Project would be consistent with the Solano County General Plan's land use and zoning designations. The Proposed Project supports the policies in both the LURMP and the Delta Plan. Therefore, there would be no impact.

Impact significance

No impact

Impact 3.14-3: Population and housing effects

The Proposed Project would not affect population or housing. No residents would be displaced or added to the site and no residences would be removed or built. As described in Section 17 Transportation and Traffic, vehicular access to one house would be adversely affected, but the house would remain habitable. Additionally, no impact to local and regional population or housing would occur because employment changes due to the Proposed Project would be limited to the construction period and most workers would likely live in in the region. There is no community on the Project site that would be divided or changed. Therefore, there would be no impact.

Impact significance

No impact

3.15 Public Services

This chapter describes existing police and fire protection services to the Project site. Other public services, including libraries, schools, and parks are not relevant to the Proposed Project because it does not include new housing or commercial uses, and therefore would not result in new demand for those services. Solid waste generation would be minimal, and limited to the construction period, so is not evaluated further in this section. Mosquito control services are addressed in Section 3.6 Hazards and Hazardous Materials.

3.15.1 Setting

Environmental setting

The Proposed Project site currently requires minimal public services. Police service is provided by the Solano County Sherriff's Office Main Station in Fairfield and fire and emergency services are provided by CAL FIRE as well as by the Montezuma Fire Protection District, which provides ambulance and emergency medical services. Prospect Island and the adjacent Wildlife Refuge also are patrolled by CDFW law enforcement officers. The property is owned by the State of California, which falls within the jurisdiction of the California Highway Patrol (CHP). The CHP acts as the State Police, and may back up or assist CDFW law enforcement officers as needed.

Solano County provides law enforcement services to prevent, respond to, and apprehend criminal activity. The majority of the law enforcement services are administered by the Solano County Office of the Sheriff. The sheriff is responsible for a variety of law enforcement services, such as safety patrol services, dispatch of safety personnel, holding custody of adult law offenders, operation of the jail and security at court facilities. The sheriff operates two jails in Solano County: the Fairfield Main Facility and the Claybank Facility. Compared with more densely populated areas in California, unincorporated Solano County has low crime rates (Solano County General Plan, page PF-31).

Fire protection service to Prospect Island is provided by CAL FIRE (J. Isaac, Solano County, pers. comm., March 2014). Prospect Island is served by CAL

FIRE's Solano Lake Napa Unit, which provides fire protection services for several unincorporated communities in Solano County.

The Montezuma Fire District provides emergency medical service to Prospect Island. Emergency services are provided by paramedics and emergency medical technicians (EMTs) who perform pre-hospital medical procedures to aid injured victims incidents that require immediate medical attention. Montezuma has seven stations, two of which are on Ryer Island.

Legal and regulatory setting

Federal and state laws and regulations

There are no federal or state laws or regulations applicable to provision of public services to Prospect Island. Local regulations are discussed below.

Local policies

The Solano County General Plan (Solano County Board of Supervisors 2008) outlines the following information and policies for Law Enforcement and Fire Protection and Emergency Services in Chapter 8 (Public Facilities and Services).

County law enforcement policies

PF.P-40: Provide an effective and responsive level of police protection (including facilities, personnel, and equipment) through the Solano County Office of the Sheriff and in coordination with city police departments.

PF.P-41: In the review and approval of County and City projects, identify and consider the law enforcement needs generated by the Proposed Project.

County fire protection and emergency services policies

PF.P-38: Ensure accessible and cost-effective fire and emergency medical service throughout the county. Facilitate coordination among city and county fire agencies and districts to improve response times, increase services levels, provide additional training, and obtain essential equipment.

PF.P-39: Identify and require incorporation of fire protection and emergency response measures in the review and approval of new projects.

3.15.2 Significance criteria

Criteria for determining significant impacts are based upon the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that a project would have a potentially significant impact on public services if it would:

> Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:
>
> i) Fire protection
> ii) Police protection
> iii) Schools
> iv) Parks
> v) Other public facilities - Vector Control, Solid Waste

3.15.3 Impacts and mitigation

Impact 3.15-1: Potential conflict with existing police and fire protection services

The Proposed Project, which would construct a northern and a southern breach on the Miner Slough levee and breach the cross levee that separates the north and south areas of the island, would not result in new housing or commercial uses and therefore would not generate additional demand for police or fire protection. During construction, there would be no change in access but some additional people (construction workers) would be on the Project site, who could require police and/or fire protection services. After construction, the Proposed Project would not increase in demand for services, but would eliminate emergency vehicle access to a privately owned parcel connected to the central portion of Prospect Island once the interior cross levee and the Miner Slough levee are breached. The permanent loss of vehicle access to this parcel would be a significant impact and is addressed (and mitigated) in the Section 3.17 Transportation and Traffic. Implementation of Mitigation Measures 3.17-1.1 and 3.17-2.1 would reduce this impact to less than significant. No additional mitigation measures are required.

<u>Impact significance</u>

Less than significant with mitigation

3.16 Recreation

This section describes existing recreation uses in the vicinity of the Proposed Project, the various plans and policies related to Sacramento-San Joaquin Delta recreation planning and development, and the regulatory agencies that oversee recreation planning and use. Although the Proposed Project does not include any recreation development, the potential impacts and benefits to recreation from implementation of the Proposed Project are discussed in this section.

3.16.1 Setting

Environmental setting

Regional recreation

The greater Sacramento-San Joaquin Delta is a maze of channels and islands at the confluence of the Sacramento and San Joaquin Rivers. The Delta region is approximately 1,150 square miles in area and provides more than 500 miles of navigable waterways, equaling more than 57,000 navigable surface acres. This vast network of river channels, sloughs, and islands provides a unique and important recreation resource in California.

Recreation uses in the Delta encompass many activities. Boating and fishing are the most popular, but recreationists also take part in wildlife viewing, sightseeing, walking, picnicking, and camping. Many of these activities overlap, and can be both water- and land-based.

Facilities supporting these activities are distributed throughout the Delta. More than 100 marinas and marina resorts operate within and on the margins of the Delta. These range from small facilities with fewer than 50 long-term berths to large facilities with more than 500 berths and additional amenities such as boat ramps, recreational vehicle (RV) and tent campgrounds, cabins, restaurants and bars, convenience stores, and picnic areas. Numerous yacht clubs are based at commercial marinas in the Delta, and more than 20 yacht clubs operate Delta facilities for their members that are separate from marinas.

Publicly owned facilities in the Delta comprise several large city-operated marinas situated on Delta waterways; several county parks that offer boat ramps, fishing access, camping, and picnic sites; and two State Park units. Federal Wildlife Refuges, State Wildlife Areas, and public and private nature preserves also are used for recreation.

Project site recreation

There are no formal recreation areas located at the Project site. Prospect Island is posted against both trespassing and hunting, though unauthorized access for hunting purposes reportedly occurs on occasion. The south property is currently leased for use by an informal "hunting club," allowing about a half-dozen participating individuals private access for waterfowl hunting. Some of these individuals may occasionally access the south property at other times, typically to install and maintain blinds and for other limited recreational purposes (C. Hagen, CDFW, pers. comm., September 2014).

The only developed recreation facility near the Project site is the Arrowhead Harbor Marina, located on Miner Slough directly across the slough from the Project site. Arrowhead Harbor Marina offers long-term berthing, dock services, RV camping (no tents), and boat launching. The recreation and access offered at Arrowhead Harbor Marina is year-round; use typically ranges from a few to a few-dozen launches per day, with peak usage reportedly corresponding to the peak months of popular fishing seasons (e.g., sturgeon from October through May; striped bass in November and May). According to the marina owners, their clientele primarily uses this marina for access to the DWSC and other Delta waters, with relatively little recreation (such as waterskiing) occurring on channels immediately adjacent to the marina (J. Fonss, Arrowhead Harbor Marina, pers. comm., May 2014).

The only public recreation area near the Project site is the Miner Slough Wildlife Area. This State Wildlife Area (SWA) is situated adjacent to the southern end of the Project site, at the confluence of Miner Slough and Cache Slough, bounded on the north by Prospect Island and on the east by Ryer Island. It is a 37-ac SWA consisting of two small islands and narrow peninsula from Prospect Island. About 10 ac are above high tide; the remainder is submerged with the exception of some mudflats during low tide. This SWA is accessible only by boat and includes riparian vegetation that supports shorebirds, waterfowl, raptors, and beavers. Bird watching, wildlife viewing, and fishing are allowed. Fishing in the surrounding sloughs is primarily for catfish, largemouth bass, crappie, and striped bass. Hunting for waterfowl is allowed year-round (no rifles or handguns allowed). There are no recreation facilities in this SWA and no permits, passes, or reservations are required.

Some informal public use of the levees and banks along the northern portion of the DWSC occurs, primarily for hunting and fishing access off of Jefferson Boulevard (SR 84). However, in the vicinity of the Proposed Project, such access to the DWSC levee is deterred by locked and signed gates, as well as other signs along area roadways that are posted and maintained by respective Reclamation Districts.

Legal and regulatory setting

Federal regulations

Unless otherwise noted, the Proposed Project would comply with the following federal regulations.

Boat Navigation Jurisdiction, Rules, and Regulations

U.S. Coast Guard

While boating law enforcement is often performed at the local level by local agencies such as county sheriff and municipal marine patrols, the Coast Guard and other federal regulators have enforcement authority in federally navigable waters. Title 14 of the United States Code (USC), CFR Title 33 and other portions of the CFR, give the U.S. Coast Guard authority for maritime law enforcement on the navigable waters of the United States, as well as responsibilities for search and rescue, marine environmental protection, and the maintenance of river aids to navigation, among other roles. Included within the Coast Guard's authority are inland waters, which are those waters shoreward of the territorial sea baseline, as defined within Title 33, Part 2. Furthermore, Title 33, Part 162 Inland Waterways Navigation Regulations, Section 162.205 addresses Suisun Bay, San Joaquin River, Sacramento River, and connecting waters within which the Coast Guard has authority and jurisdiction. Specific to the Delta, 33 CFR 162 provides regulations for the navigation by both commercial and noncommercial vessels on the San Joaquin River Deep Water Ship Channel (between Suisun Bay and Stockton) and the Sacramento River Deep Water Ship Channel (between Suisun Bay and West Sacramento).

State laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following State of California laws and regulations.

Delta Protection Commission Plans and Policies

Delta Protection Act and Land and Resource Management Plan

The Delta Protection Act (Act) of 1992 (California Public Resources Code Section 21080.22, 26 Division 19.5) established the DPC, a state entity to plan for and guide the conservation and enhancement of the Delta's natural resources while sustaining agriculture and meeting increased recreational demand. The Act defines a Primary Zone, which comprises the principal jurisdiction of the DPC.

The Secondary Zone is the area outside the Primary Zone but within the “Legal Delta”; the Secondary Zone is not in the planning area of the DPC. The DPC has appeal authority over local government actions in the Delta’s Primary Zone.

Chapter 1 of the Act (Findings and Declarations) includes the following sections.

> Section 29702 indicates that the basic goals of the state for the Delta include the protection, maintenance, and, where possible, the enhancement and restoration of the overall quality of the Delta environment, including, but not limited to, agriculture, wildlife habitat, and recreational activities.
>
> Section 29705 indicates that the Delta’s wildlife and wildlife habitats are valuable, unique, and irreplaceable resources of critical statewide significance and should be preserved and protected for the enjoyment of current and future generations.
>
> Section 29710 declares that agricultural, recreational, and other uses of the Delta can best be protected by implementing projects that protect wildlife habitat before conflicts arise.
>
> Section 29712 acknowledges that the Delta’s waterways and marinas offer recreational opportunities of statewide and local significance, are a source of economic benefit to the region, and that public safety requirements would heighten over time because increased recreational demand and use is anticipated.

Chapter 5 of the Act (Resource Management Plan) requires DPC to prepare and adopt a “comprehensive long-term resource management plan for land uses within the primary zone of the Delta.” DPC completed the Land Use and Resource Management Plan for the Primary Zone of the Delta in 1995. In February 2010, after 2 years of collaborative effort to revise the plan, DPC adopted a new draft Land Use and Resource Management Plan that includes the following recreation and access policies (Delta Protection Commission 2010, p. 22-23).

> Policy P-1: Ensure appropriate planning, development, and funding for expansion, ongoing maintenance, and supervision of existing public recreation and access areas.

Policy P-2: Encourage expansion of existing privately-owned, water-oriented recreation and access facilities that are consistent with local General Plans, zoning regulations, and standards.

Policy P-3: Assess the need for new regional public and private recreation and access facilities to meet increasing public need, and ensure that any new facilities are prioritized, developed, maintained, and supervised consistent with local, state, and federal laws and regulations. Ensure that adequate public services are provided for all existing, new, and improved recreation and access facilities.

Policy P-4: Encourage new regional recreational opportunities, such as Delta-wide trails, which take into consideration environmental, agricultural, infrastructure, and law enforcement needs, as well as private property boundaries. Also, encourage opportunities for water, hiking, and biking trails.

Policy P-5: Encourage provision of publicly funded amenities such as picnic tables and boat-in destinations that compliment and are in or adjacent to private facilities, particularly if the private facility would agree to supervise and manage such amenities, thus lowering the long-term cost to the public.

Policy P-6: Support multiple uses of Delta agricultural lands, such as seasonal hunting and provisions for wildlife habitat.

Policy P-7: Support improved access for bank fishing along state highways, county roads, and other appropriate areas where safe and adequate parking, law enforcement, waste management and sanitation facilities, and emergency response can be provided and where proper rights-of-access have been acquired.

Policy P-10: Promote and encourage Delta-wide communication, coordination, and collaboration on boating and waterway-related programs including, but not limited to, marine patrols, removal of debris and abandoned vessels, invasive species control, clean and safe boating education and enforcement, maintenance of existing anchorage, mooring, and berthing areas, and emergency response in the Delta.

California Department of Parks and Recreation

Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh

The Sacramento-San Joaquin Delta Reform Act mandated that the Department of Parks and Recreation (DPR) develop recommendations to expand state recreation areas in the region. To comply with the legislation, DPR issued the *Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh* in May 2011 (DPR 2011). Although the Recreation Proposal is not a binding policy document, and funding is not currently available to implement the recommendations, the Recreation Proposal does represent DPR's vision for the region. The document states, "The proposal recommends a network of recreation areas, including parks, resorts, boating facilities, historic communities, agritourism attractions, and other visitor-oriented businesses. These areas would be connected by scenic driving routes, boating trails, or bicycling and hiking trails… Proposal recommendations aim to provide visitors and residents authentic outdoor experiences rooted in the unique and enduring character of the Delta and Suisun Marsh."

Among recommendations for development and expansion of recreation at several Delta locations, the Recreation Proposal also recommends working cooperatively with other state agencies including DWR. Specific areas for DWR recreation consideration relevant to Prospect Island include:

- Consider recreation opportunities at flooded islands that cannot be reclaimed cost-effectively after disasters.
- Incorporate shoreline access, trails, boat ramps, hunting opportunities, and interpretive facilities as appropriate in restoration projects at Dutch Slough, McCormack-Williamson Tract, Suisun Marsh, *and other sites* (emphasis added).

State Parks' Division of Boating and Waterways regulations and programs

The primary mission of DPR's Division of Boating and Waterways (DBW) is to promote a safer and more enjoyable boating environment. Although boating law enforcement in California is typically performed at the local level by local agencies, such as county sheriff and municipal marine patrol units, DBW, through its Boating Law Enforcement Unit, acts to meet the goals of providing for adequate and consistent law enforcement through local agencies throughout the state. California boating laws are contained in instruments of state law, including the California Harbors and Navigation Code, Vehicle Code, Penal Code, and California Code of Regulations, among others. California boating laws and regulations apply uniformly on all waters of the state. California law does not replace the U.S. Coast Guard and other federal regulations in force on federally navigable waters, but it is in general conformity with these.

DBW conducts a program focused on providing funding for local boating law enforcement agencies and training of law enforcement personnel. Another DBW program aimed at boating safety is the Aquatic Center Grant Program, through which the department makes grants available for nonprofit organizations, colleges and universities, and local agencies for boating safety education.

DBW supports the purpose of providing boaters with adequate facilities on the water by providing boat launch facility grants and small craft harbor development loans to public entities. Private marina owners can also apply for construction loans for improvements, such as berthing, restrooms, vessel pump-out stations, boat launching and parking facilities, and dry boat storage.

The Aquatic Weed Control Program is authorized to control water hyacinth (*Eichhornia crassipes*), Brazilian waterweed (*Egeria densa*), and South American spongeplant (*Limnobium laevigatum*) in the Delta, its tributaries, and Suisun Marsh. The program is focused on controlling water hyacinth and Brazilian waterweed, which are highly invasive aquatic plant species that are widespread in the Delta and have substantial impacts on recreational activities in the Delta, its tributaries, and Suisun Marsh.

The Abandoned Watercraft Abatement Fund is administered by DBW with the purpose of providing funds to public agencies to remove and dispose of abandoned or wrecked vessels that pose a significant hazard to navigation.

California Department of Fish and Wildlife land management

CDFW owns and manages seven areas in the Delta, primarily for habitat and species protection and enhancement. Miner Slough Wildlife Area consists of about 37 ac situated at the confluence of Cache Slough and Miner Slough (Solano County). This State Wildlife Area is managed under the current regulations found in the California Fish and Game Code and Title 14 of the CCR. Regulations for wildlife areas and ecological reserves, as well as hunting and fishing regulations, can also be found in Title 14. The Minor (*sic*) Slough Management Plan (CDFG 1977) asserts five management objectives, the most relevant being the preservation of this area in its natural state, and the continuation of public access (by boat) and recreation “on a non-permit basis.”

California State Lands Commission regulations

The California State Lands Commission (CSLC) has jurisdiction over lands that underlie navigable and tidal waterways (Sovereign Lands). These include lands under Miner Slough adjacent to the Project site. The CSLC offers leases and permits for marinas, and developers of marinas along the state's navigable rivers, natural lakes, and bays are required by law to lease state land at marina sites. Private landowners who wish to install a recreational pier adjacent to their waterfront residence must likewise obtain a lease from the commission.

The CSLC has entered into a Memorandum of Understanding with the California Department of Water Resources to allow DWR access to Sovereign Lands required for the development, operation, and maintenance of the State Water Project and its related activities and projects.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local ordinances and policies.

Solano County General Plan

The Solano County General Plan identifies policies to maintain and expand public access and recreational activities in the Delta and Suisun Marsh, such as duck hunting, boating, fishing, and nature study. The Park and Recreation Element (Solano County Board of Supervisors 2008), adopted in 2003 and incorporated into the most recent general plan, identifies general policies for managing and improving the county's park and recreational facilities.

Solano County land located in the statutory Delta is designated as Agricultural, with a Resource Conservation overlay. The general plan includes the following policies specific to recreation in the Delta:

> Policy RS.P-26: Promote continued recreational use of the land and waters of the Delta, including fishing and boating; ensure needed recreational facilities are constructed, maintained, and supervised; protect landowners from unauthorized recreational uses on private lands; and maximize dwindling public funds for recreation by promoting public private partnerships and multiple uses of Delta lands consistent with the Land Use

and Resource Management Plan for the Primary Zone of the Delta.

Additional objectives and associated policies in the Park and Recreation Element include the following.

- Objective 3: Identify, preserve and manage significant regional recreation and natural areas.
- Policy C: The County shall work to protect identified recreational sites and natural resource areas.
- Objective 5: Encourage appropriate multiple uses of public land for recreation and other uses.

3.16.2 Significance criteria

The criteria used for determining the significance of an effect on recreational resources are based on Appendix G of the CEQA Guidelines (Environmental Checklist) and professional standards and practices. Effects on both water-dependent and water-enhanced (land-based) recreation opportunities may be considered significant for purposes of CEQA if an alternative would result in any one of the following conditions:

- The permanent loss or closure of well-established recreational facilities or activities.
- The substantial long-term reduction of recreation opportunities and experiences, such as reduction in the amount of area available for a particular type of recreation.
- Cause an increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.
- Result in potential inconsistencies with plans and policies related to the protection of recreation resources in the Proposed Project area.

3.16.3 Impacts and mitigation

Impact 3.16-1: Short-term construction-related impacts to recreational boating in Miner Slough and Arrowhead Harbor Marina

Proposed Project construction may have minor impacts upon existing (public and private) recreation use in the Proposed Project area. Use of the Arrowhead Harbor Marina and Miner Slough may be limited or prohibited during levee breaching activities due to safety hazards. Implementation of Mitigation Measure 3.16-1.1 would reduce these impacts to less than significant.

Leased recreation access on the south property may not be allowed during the construction period due to safety hazards similar to those described above, so existing use by a few individuals would be diminished over the 3-year construction period. This activity is managed at the discretion of DWR.

The interruption in recreational use of the Proposed Project area due to construction activities may be significant, but implementation of Mitigation Measure 3.16-1.1 would reduce this impact to less than significant.

Mitigation Measure 3.16-1.1

Speed limit zones or channel closure shall be established by DWR during in-water construction along Miner Slough. The construction contractor shall post and distribute notifications at Arrowhead Harbor Marina and other local boating access sites of any scheduled imposition of boating safety speed limits or channel closure 14–30 days in advance of water-based construction work.

Impact significance

Less than significant with mitigation

Impact 3.16-2: Long-term impacts to recreational boating in Miner Slough and Arrowhead Harbor Marina

Post-project hydrologic conditions in Miner Slough may have indirect minor impacts upon future public recreation use in the area, primarily recreational boating.

Prospect Island Tidal Habitat Restoration Project Phase 1 modeling indicated that potential changes to water velocity and flow direction at the Arrowhead Harbor Marina entrance may be adversely affected by a levee breach located along Miner Slough and relatively close to the marina (SWS and WWR 2012). Therefore, the breach location was moved 2,640 ft (0.5 miles) downstream. Subsequent modeling of the re-located breach under Phase 2 indicated that there would be negligible change in velocity at the Arrowhead Harbor Marina's entrance under normal and low-flow conditions (Appendix D in WWR and SWS 2014). Under high and flood flows, the modeled water velocity tangential to the marina entrance increases from approximately 1 foot per second (fps) to approximately 2.5 fps (WWR and SWS 2013b). Modeled mid-channel velocity in Miner Slough increases from about 1.5 fps to 2 fps under normal tidal low-flow conditions, and from about 3 fps to about 5 fps under high-flow flooding conditions.

The anticipated minor changes in Miner Slough water velocity profiles during normal tidal conditions are not expected to discernibly affect boating safety or the ease of access to Arrowhead Harbor Marina. While higher water velocities would be expected to occur in Miner Slough during high-flow and flood conditions, little or no boat traffic is typically present during such conditions (J. Fonss, Arrowhead Harbor Marina, pers. comm., May 2014). Furthermore, high flow conditions and velocities would be within the range of such conditions in other nearby Delta channels, and thus Miner Slough navigation under such conditions would not present challenges to boat operators or require skills that would not otherwise be reasonably encountered and required elsewhere in the Delta. Overall, boating impacts of increased velocities in Miner Slough near the entrance of the Arrowhead Harbor Marina would be less than significant.

Impact significance

Less than significant

Impact 3.16-3: Long-term impacts on recreational use of Prospect Island

There is currently no authorized recreational use of the interior of the north property, and limited hunting use of the south property (Section 3.16.1 Recreation – Setting). The Proposed Project does not include any facilities for recreation or watercraft use. After the levee is breached and construction is complete, the Proposed Project would provide navigable sloughs and open water areas. Access for recreation would be dependent on the property’s legal designation and compatibility with project goals, objectives, and mitigation requirements. The potential for enhanced or additional developed recreation opportunity would remain for future consideration, although no such development or partnerships are currently included in the Proposed Project.

Impact significance

No impact

Impact 3.16-4: Consistency with existing plans

The Proposed Project does not include developed facilities for increased public recreation or watercraft use. However, the restored area may, dependent upon compatibility with project goals, objectives, and mitigation requirements, allow opportunity for public access by watercraft; increase the amount of open water available for boating; and potentially provide new hunting, fishing, and wildlife viewing opportunities. Restoration of Prospect Island to a tidal system may increase the availability of wildlands and wetlands for recreational use. The potential for enhanced or additional developed recreation opportunity would remain for future consideration, even though no such development or partnerships are initially part of Proposed Project implementation. Providing these opportunities is consistent with multiple-use and general recreation enhancement policies in the Delta Plan and Solano County General Plan.

Impact significance

Less than significant

3.17 Transportation and Traffic

This section describes and assesses the impacts of transportation and traffic on and near the Project site. The Proposed Project would generate some short-term traffic from mobilization of construction equipment, workers accessing the site during construction, and possibly importation of fill. Long-term traffic impacts may occur due to levee breaching, which would eliminate existing access along a portion of the Miner Slough levee. This analysis is based on field reconnaissance and review of applicable maps, plans, and policies.

3.17.1 Setting

Environmental setting

Regional traffic

From the San Francisco Bay Area to Prospect Island, travelers would use Interstate 680 (I-680) or I-80 to State Route 12 (SR-12) to SR-84 along the Ryer Island levee. From the Sacramento area, Prospect Island is accessible via I-80 to SR-84. The latter is a split-section California State Highway consisting of two sections. The first section is an east–west arterial road running from San Gregorio to Menlo Park, across the Dumbarton Bridge through Fremont and Newark, and ending at I-580 in Livermore. The other section is a north-south arterial road that begins at Route 12 in Rio Vista, passes through Ryer Island (where it connects to Route 220), and ends at the I-80 interchange in West Sacramento.

A ferry provides the crossing over Cache Slough from Rio Vista to Ryer Island. The ferry, a diesel-powered boat operated by Caltrans, is in operation twenty-four hours per day and charges no toll.

Local traffic

Local vehicle access between Ryer Island and Prospect Island is provided via SR-84, SR-220, and Ryer Road. On Prospect Island, there are access roads on the Deep Water Ship Channel levee, Miner Slough levee, the north levee, and the interior cross levee.

Access between Prospect Island and adjacent areas (i.e., Arrowhead Harbor Marina, privately owned parcel adjacent to the Project site, nearby Ryer Island agricultural lands) occurs via the Ryer Island levee and the levee road that connects Ryer Island and the DWSC. Currently, access to the privately owned parcel is on a gated road along Miner Slough. However, legal access to this parcel is via roadways atop the north levee and DWSC levees, then across the interior cross levee and up Miner Slough levee (Figure 2.1-2).

Legal and regulatory setting

Federal laws and regulations

No federal traffic/transportation laws or regulations are applicable to the Proposed Project.

State regulations

Unless otherwise noted, the Proposed Project would comply with the following state regulations.

Caltrans State Route 84 Corridor Systems Management Plan

The Caltrans Corridor Systems Management Plan (CSMP) is a transportation planning document that reports on existing and future traffic conditions and proposes traffic management strategies and capital improvements to maintain and enhance mobility within each corridor (SR84, CSMP, December 2010). Route 84 is legally defined to continue from I-580 to Route 4 in Antioch, but there are currently no plans in place to bridge the gap between the Bay Area and delta segments of the route.

Local ordinances and policies

While the Proposed Project need not comply with local ordinances and policies, the following have been considered in the analysis of potential impacts and identification of mitigation, as needed.

Unless otherwise noted, the Proposed Project would comply with the following local ordinances and policies

Solano County General Plan

The Transportation and Circulation chapter of the Solano County General Plan (Solano County Board of Supervisors 2008) sets forth the policy framework to shape circulation within Solano County. Roadways carrying vehicular traffic represent the primary components of circulation, but other methods of travel are also addressed—bicycle systems, pedestrian connectivity, bus transit, air service, rail service, and waterway activity. Solano County is expected to continue to experience traffic growth as a result of development within local jurisdictions and the unincorporated county and continued growth in the surrounding counties.

Relevant policies

The Solano County General Plan (Solano County Board of Supervisors 2008) includes the following policies relevant to Proposed Project impacts:

> TC.P-1: Maintain and improve current transportation systems to remedy safety and congestion issues, and establish specific actions to address these issues when they occur.
>
> TC.P-9: Plan, fund, build, and improve roadways that support agriculture by providing increased connectivity across Interstate 80, including the intersection at Pedrick Road, for farmers and their equipment, and by grading and paving unimproved rural roads.
>
> TC.P-10: Anticipate increases in vehicular traffic on rural roads that serve agricultural-tourist centers, value-added agricultural uses in the interior valleys, and other unique land uses; complete related roadway improvements that support the viability of such uses.

3.17.2 Significance criteria

Criteria for determining significant impacts are based upon the CEQA Guidelines (Appendix G) and professional judgment. These guidelines state that a project would have a potentially significant impact on public services if it would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.
- Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or

other standards established by the county congestion management agency for designated roads or highways.

- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).
- Result in inadequate emergency access.
- Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

3.17.3 Impacts and mitigation

Impact 3.17-1: Potential traffic impacts during construction

Construction activities that could affect traffic include: truck traffic from workers accessing the Project site, transportation of construction equipment and imported materials after the site is dewatered, construction and use of temporary staging areas, site revegetation, and demobilization of equipment once construction is completed. Depending on location and operation of these activities, they may temporarily impede access to the Arrowhead Harbor Marina and the privately owned parcel adjacent to Miner Slough in the central portion of Prospect Island, as well as maintenance and emergency access to Prospect Island levees. This impact would be potentially significant and reduced to a less-than-significant level with mitigation.

The Proposed Project would generate small amounts of off-site traffic during construction. Much of the off-site traffic associated with the Proposed Project would occur during equipment mobilization and de-mobilization. The construction equipment would be brought to the site on flatbed trucks, requiring trips for mobilization and de-mobilization event. These trips would occur over a period of a few days, and would be minimal on an hourly basis.

Also, in the first construction year, assuming all import fill and aggregate base would be transported directly to the Project site by barge, there would not be substantial use of public roadways by haul trucks carrying fill and aggregate. Loading and unloading of the barges would require trucks at the material source (quarry) and destination (levee roads at Project site). However, none of this truck traffic would occur on public roadways. For other imported materials, a maximum of 350 round trips with various types of trucks would be required. These trips would occur during a roughly 2-week period at the beginning of the construction period, with a maximum of 35 round trips/day (70 one-way trips). These trips would occur at a rate of about 5 trucks/hour over an 8-hour work-day.

At the end of the construction period prior to Miner Slough levee breaching (2020), planting materials import and temporary sheet pile removal would occur by truck, resulting in less than ten truck trips per day for a period of a few weeks. Traffic related to workers accessing the Project site throughout the construction period would be limited to approximately 20 trips/day. Overall, this level of trip generation would not adversely affect traffic flows or safety along local and regional roadways, because of the low level of trips that would be generated compared with roadway capacity. Additionally, local roadways are currently used by large trucks and farm vehicles similar to those proposed for the Proposed Project. Therefore Proposed Project traffic impacts to off-island roadways would be less than significant.

Mitigation Measure 3.17-1.1

The construction contractor shall submit a traffic control plan to DWR for review and approval that shall limit impacts to adjacent land owners and businesses. The control plan shall include temporary measures, such as the following:

- Advance public notification signage at the Project site prior to the start of construction activities, to alert drivers to pending construction work and traffic restrictions.
- Temporary railing, barricades, crash cushions, signage, lighting and flashing lights, pavement markings, and the service of qualified flaggers; all as required to provide for the safe passage of public traffic through or around the work zones.
- Other safety measures as required to control vehicular and pedestrian traffic through the work zones.

Impact significance

Less than significant with mitigation

Impact 3.17-2: Potential long-term loss of access to the Miner Slough levee

The Proposed Project would create two breaches in the Miner Slough levee and a single breach in the interior cross levee. This would eliminate vehicle access across the interior cross levee and to the portion of the Miner Slough levee between the breaches following Proposed Project construction. This includes loss of access to the privately owned parcel connected to the central portion of the north property, via either the cross levee or the northern portion of the Miner

Slough levee, and maintenance and emergency access to the cut-off portion of the Miner Slough levee. Implementation of Mitigation Measure 3.17-2.1 would reduce these impacts to less than significant.

Because there is currently no land access to Hall Island from the Miner Slough levee and the property is flooded, there would be no potential conflicts with existing land uses on the property.

Mitigation Measure 3.17-2.1
DWR shall mitigate the loss of access by reaching an access settlement through property or easement purchase, design and construction of alternative water conveyance through the interior cross levee (e.g., culverts), or providing alternative means that maintain physical access for affected residents and emergency vehicles.

Impact significance
Less than significant with mitigation

3.18 Utilities

This section describes the utility infrastructure and easements in the Proposed Project area. The utilities impact assessment focuses on potential impacts to electrical, gas, communications, water supply, sewer infrastructure, solid waste facilities, and deeded easements for the Proposed Project. Mitigation measures are provided for any significant impacts. For discussion of potential impacts related to irrigation infrastructure (i.e., intakes, drains) in the Prospect Island area see Section 3.1 Hydrology.

3.18.1 Setting

Utility infrastructure and deeded easement locations are based on field surveys performed by DWR in 2010, a title report map showing property boundary and easement holders (DWR 2014c, Figure 2.1-2, Figure 2.1-3), nautical charts (NOAA 2014), aerial photograph interpretation (Google Earth), Division of Oil, Gas, and Geothermal Resources Well Finder online database (DOGGR; DOGGR 2014), and past known land use activities.

Environmental setting

Overview

Historically, Prospect Island was used for agricultural purposes, with two associated residences: the Hall property on the south property and the privately owned parcel connected to the central portion of the north property along Miner Slough. To serve the agricultural uses and the residences, overhead electrical and telecommunication utilities were established. Surveys for underground utilities have not been performed on Prospect Island. An examination of desktop resources such as NOAA Nautical Charts, Google Earth, Google Street View, etc. did not show signs (natural gas paddles, signs indicating buried lines, storm drain inlets, etc.) of any underground utilities. Due to the rural setting, water and wastewater service is most likely supplied through onsite sources (i.e., wells, water pumps, septic systems, and outhouses). Transmission and distribution natural gas lines also do not appear to have been constructed most likely due to the rural location and the small potential service population within the vicinity. Pacific Gas and Electric Company (PG&E) confirms no existing natural gas pipelines are located within the Project site (P. Davis, pers. comm., 2015). A number of exploratory natural gas wells exist in the Proposed Project area. However, these wells at present have been capped and abandoned (DOGGR 2014), and no above-ground infrastructure associated with these wells exists.

Several maintenance and flood control easements owned by PG&E and the Sacramento San Joaquin Drainage District (District) are recorded on Prospect Island. These infrastructure elements are described in detail below.

Electrical and telecommunication systems

The existing electrical/telecommunication distribution infrastructure on the north property is owned by PG&E, and is currently inactive. Electrical distribution lines cross over Miner Slough from Ryer Island via spliced wooden poles (Figure 3.18-1) approximately 2,000 ft south of the Highway 84/Elevator Road intersection, or approximately 1 mile north of the Prospect Island internal cross levee. These lines then connect to poles located along the landside toe of the west levee of Miner Slough and travel 1,000 ft northwest moving into Prospect Island's interior. The distribution lines then veer southwest making a "C" shape and run to the privately owned parcel (Figure 2.2-3). DWR field surveys found these distribution lines were downed and/or submerged under water, entangled in existing vegetation, and PG&E has confirmed that these lines are currently inactive.

Figure 3.18-1. View of Spliced Wooden Poles, Looking North from Within Miner Slough.

PG&E also owns an electrical distribution tower which is located approximately 0.86 miles north from the Prospect Island internal cross levee along the DWSC (western side of Prospect Island) landside levee toe. This tower once held electrical distribution lines that spanned the DWSC, which originated from the west on Liberty Island and traveled in a southeast direction into the interior of Prospect Island. Recently PG&E has contacted DWR about their plans to remove the tower (D. Riordan, pers. comm., July 2014). To ensure that the tower would not impact restoration efforts in the event of structural failure, DWR has opted to have PG&E completely remove the structure which includes the lattice framework, cement footings, and 1 to 2 feet of soil.

Field research has not yet been undertaken for the south property; typically field surveys occur after DWR takes title of the property. An examination of NOAA nautical charts do not indicate the presence of distribution lines across Miner Slough or the DWSC onto this portion of the island, and no above-ground distribution lines are visible on current Google Earth aerial imagery going back to 1993.

<u>Water, wastewater, and stormwater systems</u>

As discussed above, no municipal potable water, wastewater, or storm water infrastructure occurs on the north property. Information gathered from desktop resources indicates that these utilities were most likely supplied by domestic sources for the former agricultural and residential needs.

No known field surveys have been conducted on the south property; currently no underground surveys are planned as DWR does not perform underground utility surveys when acquiring new properties. A desktop review of nautical charts and of Google Street View does not indicate the presence of pipelines within the DWSC, Miner Slough, or within the vicinity of the Proposed Project.

Natural gas transmission/distribution lines

The DWR property boundary and easement maps, nautical charts, aerial photograph interpretation, and Google Street View do not provide evidence of underground natural gas lines on either the north or south property. PG&E confirms no existing natural gas pipelines are located within the Project site (P. Davis, pers. comm., 2015). Currently no surveys are planned as DWR does not perform underground utility surveys when acquiring new property.

Natural gas wells

Six capped exploratory natural gas wells exist on the north property along the northwestern side of the island. Of these six, five were found to be non-productive/dry at the time of drilling and were subsequently capped and abandoned. The sixth well was open from 1956 to 1965, after which it was capped and abandoned (DOGGR 2014). As a result, no active natural gas lines which service these natural gas wells exist on the north property. Currently, these six gas wells are believed to be capped to industry standards. Industry standards for capping natural gas wells typically require (a) filling the casing with a sealing material (typically cement), (b) cutting the casing off 5 to 10 ft below the surface, and then (c) backfilling the area with native soil.

Field surveys have not been performed for the south property and there are no planned surveys in the foreseeable future since DWR does not perform underground utility surveys when acquiring title of a new property. A review of the DOGGR database for natural gas wells on the south property did not return any well listings.

See Section 3.9 Mineral Resources for more information and further discussion regarding these natural gas wells.

Solid waste

The following landfills are located 30–35 miles (driving distance) away from Propsect Island and could accommodate the Proposed Project solid waste disposal needs:

- *Potrero Hills Landfill, Suisun City, California.* At present this facility is permitted to handle various waste types, including construction material & debris (i.e., asphalt, bricks, concrete, dirt /clean fill, dry wall /gypsum/

sheetrock), scrap metal, appliances, organics (i.e., pallets, plywood scrap, sawdust, straw/hay, untreated wood debris and scraps, and yard trimmings) (http://www.co.contra-costa.ca.us/depart/cd/recycle/options/ v6592.htm).

- *L and D Landfill and Material Recovery Facility, Sacramento, California.* At present this facility primarily receives construction and demolition debris and other non-hazardous waste (http://www.landdlandfill.com/).
- *Yolo County Central Landfill, Woodland, California.* At present this facility receives mixed construction and demolition debris, restricted green waste, and other non-hazardous waste (http://www.yolocounty.org/community-services/planning-public-works/integrated-waste-management-division/central-landfill).

Although located further away (approximately 50 miles driving distance), the Recology Hay Road Landfill near Vacaville also accepts contaminanted soils and some types of hazardous waste.

Utility easements

Pacific Gas and Electric

PG&E maintains easements on the north property for electrical and communication purposes. As shown in Figure 2.1-2, an "X" shaped easement has been established for the electrical distribution steel tower located near the DWSC. An additional 20-ft-wide by 400-ft-long easement is located around the remnant distribution line associated with the steel tower. PG&E also has an easement along an abandoned power pole line that originates within the south property just south of the internal cross levee and extends into the north property for a little over one mile (Section 3.18.1 Utilities – Setting – Electrical and Telecommunication Systems).

DWR has not conducted research for the south property; however there is no evidence that PG&E owns any additional easements within this area.

Sacramento San Joaquin Drainage District

The District currently holds an easement for the passage of the floodwaters from the Yolo Bypass across the north property.

DWR has not conducted research for the south property; however it is anticipated that the District does not currently own any easements within this area.

Legal and regulatory setting

Federal laws and regulations

No federal laws or regulations that regulate utilities would apply to the Proposed Project.

State laws and regulations

Unless otherwise noted, the Proposed Project would comply with the following state laws and regulations.

California Integrated Waste Management Act

The California Department of Resources Recycling and Recovery (CalRecycle) provides regulatory oversight of solid waste management facilities. The California Integrated Waste Management Act (Assembly Bill [AB] 939, Sher, Chapter 1095, Statutes of 1989, as amended) made all California cities, counties, and regional solid waste management agencies responsible for planning and implementing diversion of solid waste from solid waste disposal facilities. CalRecycle oversees and assists local governments to develop and implement the mandates and subsequent legislation. Furthermore, activities involving removal and disposal of sediments within irrigation and flood control facilities or the use of inert materials in levee or flood control work by federal, state, or local governments may be excluded from solid waste permitting by CalRecycle Tiered Regulatory Placement criteria for construction and demolition waste and inert debris disposal. However, these activities would require permitting by the Regional Water Quality Control Boards in implementing Title 24 Waters of the California Code of Regulations and State Water Resources Control Board requirements for dredging, filling, and disposal of dredge wastes (CalRecycle 2006).

CalOSHA Title 8: Section 1541

This policy requires that subsurface installations be identified and marked prior to excavation activities. The excavator must receive a response from all known owners/operators of subsurface installations and must meet with owners/operators of high priority (such as high pressure pipelines, natural gas/petroleum pipelines, electrical lines greater than 60,000 volts, etc.) subsurface installations within 10 ft of the proposed excavation before opening the excavation. Only qualified persons (persons that meet training and competency requirements) can perform subsurface installation locating activities. All proposed employees must be trained in excavator notification/excavation activities. Excavators must immediately notify the subsurface installation owner/operator of any damage discovered during or caused by excavation activities.

Protection of Underground Infrastructure (California Government Code, Section 4216)

Utility locator qualification requirements are published under California Government Code 4216, which require that: (a) only a qualified person shall perform subsurface locating activities (4216.3) and (b) a qualified person performing subsurface installation locating activities on behalf of a subsurface installation operator shall use a minimum of a single-frequency utility locating device and shall have access to alternative sources for verification if necessary (4216.3).

Public Resources Code [PRC 3208.1]

Section 3208.1 of the PRC authorizes the State Oil and Gas Supervisor of the DOGGR to order the re-abandonment of a previously abandoned well when construction of any structure over or in the proximity to a well could result in a hazard. The cost of re-abandonment operations is the responsibility of the owner or developer of the project upon which the structure would be located.

Local ordinances

The Solano County Municipal Code Chapter 26.5-10 through Chapter 26.5-19 deal with the placement of utilities. However, these sections within Chapter 26.5 deal specifically with the establishment of district areas to facilitate the removal of above ground utilities in lieu of underground utilities. No other specific Solano County Municipal Code deals with only the installation/removal of utilities.

3.18.2 Significance criteria

Criteria for determining significant impacts are based on the CEQA Guidelines (Appendix G) and professional judgment. Guideline criteria regarding wastewater treatment facilities are excluded from this list because the Proposed Project would not have any potential to affect or require any such facilities. Applicable guidelines state that the Proposed Project would have a significant impact on utilities if it would:

- Be served by a landfill with insufficient permitted capacity to accommodate the Proposed Project’s solid waste disposal needs; or
- Be unable to comply with federal, state, and local statutes and regulations related to solid waste.

The following additional criteria would be used to assess potential impacts to utilities and easements:

- Result in an adverse effect on existing utilities.

- Result in an adverse effect to deeded easement holders

3.18.3 Impacts and mitigation

Impact 3.18-1: Solid waste disposal impacts

A small volume (less than 100 cubic yards) of cleared materials may be hazardous and would need to be off-hauled to a landfill that would accommodate these materials. Hazardous materials may include such items as the wooden electrical distribution poles, which may have been treated with quantities of pentachlorophenol, copper naphthenate, and/or other materials on the State Toxic Characteristic List. Other hazardous materials may include lead paint from old buildings, and soil excavated from areas where activities related to the remnant natural gas wells may have contaminated the soil with drilling fluids additives like Barite (barium salt), polymers, and oil based compounds (DWR 2009).

As described in Section 3.18.1 Utilities – Setting, above, there are four local landfills that could accommodate the Proposed Project solid waste disposal needs (i.e., Recology Hay Road Landfill, Vacaville; Potrero Hills Landfill, Suisun City; L and D Landfill and Material Recovery Facility, Sacramento; Yolo County Central Landfill, Woodland) and therefore the impact would be less than significant.

Impact significance
Less than significant

Impact 3.18-2: Potential for adverse effects on existing utilities

The Proposed Project would require the removal of the PG&E distribution lines and poles within Prospect Island. These distribution lines at one time served the residences and provided power for the Island's agricultural needs (i.e., water pumps). These lines have fallen in a state of disrepair and are no longer active. DWR is currently in discussions with PG&E about removing the distribution lines within the Proposed Project area following site dewatering. Because the power lines are abandoned there would be no impact on existing utilities.

The various sources consulted (as mentioned previously) failed to find evidence of underground utilities within the Proposed Project area. Therefore the Proposed Project would be unlikely to impact underground utilities. However, it is possible that some unknown or unmarked subsurface utilities may exist on the site (i.e., old pipelines or septic tanks) that could be encountered during grading operations. This impact would be reduced to a less-than-significant level by implementation of Mitigation Measure 3.18-2.1, below.

Mitigation Measure 3.18-2.1

Prior to any ground disturbing activities DWR and its contractors shall perform the following:

- Coordinate with local utility owners to discuss the potential for the existence of underground utilities within the Proposed Project area.
- If utility owners verify the potential for underground utilities, a qualified person shall perform a subsurface survey to identify the exact location of underground utilities within the Proposed Project area, so those utilities may be avoided. If the utilities cannot be avoided, they shall be removed in a manner consistent with CalOSHA Title 8 Sections 1539 through 1541.1.

Impact significance

Less than significant impact with mitigation

Impact 3.18-3: Potential for adverse effects to easement holders

The Proposed Project restoration extent would include all of Prospect Island, and as a result the easements maintained by PG&E and the District on the north property would be restored into tidal marsh land. While the easement maintained by the District for the passage of the floodwaters would be compatible with the planned purpose of the Proposed Project, the easements maintained by PG&E would not. The restoration component feature would not inhibit PG&E from accessing their easements, but the placement of materials and/or structures (i.e., dredge materials, or electrical infrastructure) may impact restoration efforts within the Proposed Project area. Currently, DWR plans to manage this conflict of land use through negotiations with PG&E about quitclaiming their easements within Prospect Island.

Impact significance

Less than significant

3.19 Cumulative Impacts

3.19.1 Approach

CEQA requires the evaluation of a project's cumulative impacts on the physical environment (*State CEQA Guidelines*, CCR Section 15130). Cumulative impacts are two or more individual effects that when considered together are considerable or increase other environmental impacts (*State CEQA Guidelines*, CCR Section 15355).

Cumulative impacts may arise when individual effects originate from a single project over its multiple phases, or from a number of separate projects that are occurring within similar timeframes and geographical areas as that of the Proposed Project. Moreover, potential adverse changes to the physical environment due to cumulative impacts may arise with the incremental impact of the Proposed Project when combined with other closely related past, present, and reasonably foreseeable future projects (PRC Section 21083(b) and *State CEQA Guidelines*, CCR Section 15355[b]).

To determine if an impact is cumulative, three determinations must be made:

1. Does the project have an impact on the resource in question?
2. Is the combined impact of the project and other projects significant (*State CEQA Guidelines*, CCR Section 15130[a][2])?
3. Is the project's incremental effect Cumulatively Considerable (*State CEQA Guidelines*, CCR Section 15130[b])?

A cumulative impact is considered significant if the combined impact is significant and the Proposed Project's incremental effect is found to be cumulatively considerable, in the context of impact intensity and sensitivity of the resource. Additionally, CEQA states that when a project's contribution is not cumulatively considerable, then the EIR need only note the reason why and then no further discussion is required.

To perform the cumulative impact analysis, CEQA recommends relying on one of two approaches (or a combination of these):

- List Approach. A list of past, present, and probable future projects producing related or cumulative impacts; or,
- Projection Approach. A summary of projections contained in an adopted general plan or planning document, or in a prior environmental planning document, which has been adopted or certified, that describes or evaluates regional or area-wide conditions contributing to the cumulative impacts.

3.19.2 Cumulative projects considered in this EIR

This EIR uses the "List Approach", which involved developing a list of past, present, and probable future projects producing related or cumulative impacts (Table 3.19-1). The list includes planned, approved, or reasonably foreseeable future wetlands restoration, structural fish habitat enhancement projects, resource management projects and programs, Flood Protection, and Water Supply, and Navigation Projects and Programs.

A number of development activities are proposed in Sacramento County, to the east of the Proposed Project. Sixty-two private projects are listed on the Sacramento County planning projects website (http://www.planningdocuments.saccounty.net/). However, none of these private projects would result in an overlapping contribution with any of the Proposed Project's impacts. A number of private development projects are also proposed in Yolo and Solano counties, to the north and west of the Proposed Project (http://www.yolocounty.org/community-development/planning-public-works/planning-division/current-projects). Similarly, none of the private development projects in Yolo and Solano counties would result in an overlapping contribution with any of the Proposed Project's impacts. Therefore no County development projects are included on the list.

Table 3.19-1. List of Related Projects Utilized in Conducting the Cumulative Impacts Analysis for the Proposed Project

Names of Related Projects and Lead Agencies	Location	Brief Descriptions	Status as of October 2015
		TIDAL WETLAND RESTORATION PROJECTS	
Lindsey Slough Freshwater Tidal Marsh Enhancement Project (California Department of Fish and Wildlife [CDFW])	Lindsey Slough, Solano County	Enhance about 165 ac of tidal marshes on an approximate 927-ac parcel by removal of features that restrict flow through the slough, excavate starter channels to initiate channel evolution and promote tidal flow, and potentially block Calhoun Cut. This activity is part of the Cache Slough Area Restoration effort and DWR's Interim Delta Actions.	Project is complete. CDFW (2013)
Dutch Slough Tidal Marsh Restoration Project (Department of Water Resources [DWR] and California State Coastal Conservancy)	Oakley, Contra Costa County	Create and manage approximately 560 ac of tidal marsh as well as enhance or restore an additional 400 ac of managed non-tidal marsh, subtidal open water, irrigated pasture, riparian forest, and native grassland. The Project has three goals: to provide ecosystem benefits including habitats for sensitive aquatic species, to assess the development of those habitats and measure ecosystem responses so that future Delta restoration projects would be more successful, and to provide opportunities for public access, education, and recreation.	Draft Supplemental EIR released January 2014. Public Comment period closed March 7, 2014. For more information: http://www.water.ca.gov/floodsafe/fessro/environmental/dee/dutchslough/index.cfm
Lower Putah Creek Realignment Project (CDFW)	Lower Putah Creek from the Toe Drain to Yolo Bypass Wildlife Area west boundary, in central Yolo Bypass, Yolo County	Reroute Lower Putah Creek across the Yolo Bypass through four to five miles of new stream channel and seasonal wetland complex and construct fish passage migration access to Lower Putah Creek upstream of the Yolo Bypass Wildlife Area. The new realigned channel would connect to tidal channels that would also be enhanced. The Project would establish between 300 to 700 ac (five miles of stream) of creek and associated floodplain and tidal marsh habitat.	Project in CEQA review. Construction planned to begin Summer 2016 or later.
Lower Yolo Wetland Restoration Project (State and Federal Contractors Water Agency [SFCWA])	Southern Yolo Bypass, Yolo County	Restore 1,100 ac to tidal marsh to provide important new sources of food and shelter for delta smelt and other native fish species and provide rearing habitat for out-migrating salmonids. As part of California Eco Restore, the project would partially fulfill the state and federal requirement to restore 8,000 ac of wetland habitat in the Delta.	Final EIR completed July 2013 and certified. For more information: http://www.sfcwa.org/2013/04/22/draft-eir-lower-yolo-ranch-tidal-restoration-project/
North Delta Flood Control and Ecosystem Restoration Project (McCormack-Williamson Tract) (DWR)	Confluence of Mokelumne and Cosumnes Rivers, Sacramento County	The Nature Conservancy, UC Davis, and DWR are partnering to restore the 1,600-ac site to tidal marsh. Part of the North Delta Flood Control and Ecosystem Restoration Project.	Final EIR completed in 2010. Construction likely to take two to three construction seasons. For more information: http://www.water.ca.gov/floodsafe/fessro/levees/north_delta/docs/
Tule Red Wetland Enhancement Project (SFCWA)	Suisun Marsh, Solano County	Restore approximately 350 ac of tidal wetlands in Suisun Marsh to provide habitat for important native fish species, such as delta smelt and salmon. The Project is part of current restoration requirements for the State and Federal Water Projects.	Project in planning stage. For more information: http://www.sfcwa.org/2013/03/27/tule-red-restoration-project/
Mein's Landing Wetland Restoration Project (DWR)	Suisun Marsh, Solano County	Restore 666 ac to tidal marsh habitat in Suisun Marsh, which would provide habitat for marsh-dependent sensitive plant and animal species. The property is currently operates as a duck club and managed wetland. Project planning is currently on hold.	Project planning currently on hold. For more information: http://www.water.ca.gov/deltainit/action.cfm
Overlook Club Wetland Restoration Project (DWR)	Suisun Marsh, Solano County	Restore 160 ac of tidal marsh to support recovery of delta smelt, salmonids, and longfin smelt as well as other listed species.	Project in planning stage. Pre-restoration control of Phragmites may occur. For more information, see page 4-5 at the following: http://www.water.ca.gov/environmentalservices/docs/frpa/FRP_Annual_Report_Final_and_signed_Jan%202014.pdf

Names of Related Projects and Lead Agencies	Location	Brief Descriptions	Status as of October 2015
Hill Slough Wetland Restoration Project (CDFW)	Suisun Marsh, Solano County	Restore brackish tidal marsh and associated upland ecotone at the northern Suisun Marsh to benefit endangered as well as migratory and resident species. This Project involves creating 940 ac of tidal wetlands in Suisun Marsh. Consistent with Ecosystem Restoration Program (ERP) goals and objectives by reducing the risk of entrainment of at-risk, native anadromous species of concern including spring-run and winter-run Chinook Salmon, Steelhead trout, and Green Sturgeon, as well as other resident and transitory fish species in the Suisun Bay.	DEIR scheduled to be released Summer 2014. For more information: http://www.dfg.ca.gov/ERP/erp_proj_hill_slough.asp
Goat Island Restoration Project (Solano Land Trust)	Suisun Marsh, Solano County	The restoration Project would restore tidal influence to a 70-ac diked marsh situated in the northwest corner of Rush Ranch Open Space Preserve, and two small stream restoration Projects.	In CEQA review. For more information: http://www.landtrustalliance.org/climate-change-toolkit/adapt/habitats/tidal-marsh-preservation-at-rush-ranch
		OTHER WETLAND RESTORATION AND ENHANCEMENT PROJECTS	
Lower Putah Fisheries Enhancement Project (Solano County Water Agency)	Lower Putah Creek from the Yolo Bypass Wildlife Area west boundary upstream to Monticello Dam, Yolo County	Remove fish barriers on 25 miles of Lower Putah Creek and restore and enhance anadromous fish spawning and rearing habitats on Lower Putah Creek east of Davis.	Project in CEQA review. Construction planned to begin Summer 2016 or later.
Capital Conservation Bank (American Habitats)	North end of County Road (CR) 107, east of CR 152 in the Southern Yolo Bypass, Yolo County	Establish and manage a giant garter snake conservation bank on 137 ac of land (Phase 1). Phase 2 may be implemented following success of the first 137-ac parcel.	Project in planning stage. Habitat Development Plan released April 2013. For more information: ftp://ftp.water.ca.gov/mailout/CVFPB%20Outgoing/18856_EP%20Application_GGS_YoloBp/18856_Habitat%20Development%20Plan.pdf Although construction was planned for summer/fall 2013, as of March 2014 construction has not begun. For more information: http://yoloagenda.yolocounty.org/print_ag_memo.cfm?seq=1688&rev=0&mode=External&reloaded=true
Conaway Ranch Floodway Corridor and Habitat Enhancement Project (California Waterfowl Association [CWA])	North-central Yolo Bypass, Yolo County	Establish an approximately 17,300-ac seasonal floodplain habitat for both flood protection (i.e., transitory storage of over 66,000 ac-ft of flood water during large storm events) and habitat restoration. Re-create historical floodplain habitat for salmon, splittail, and other native fish spawning and/or juvenile rearing. Construct improvements to New Sacramento River Bypass/Weir to provide for fish passage (e.g., new vertical slot weir and/or fish ladders or improvements). Other opportunities include integrated water management and recreation/open space.	Project in planning stage. For more information: http://www.conawayranch.com/ In 2012, the Wildlife Conservation Board issued a grant to the California Waterfowl Association to acquire a conservation easement on the ranch for protection of agricultural-friendly habitat areas, supporting migratory waterfowl and other bird, amphibian and reptile species. For more information: http://www.ceqanet.ca.gov/NOEdescription.asp?DocPK=666975
Knaggs Ranch Project (Formerly known as the Elkhorn Basin Ranch) (Sacramento Area Flood Control Agency [SAFCA])	Northern Yolo Bypass, Yolo County	The 1,682-ac property was acquired in 2008 to permanently preserve land for agriculture, wildlife habitat, and open space use. The Project plans to develop and manage approximately 850 ac of seasonal floodplain habitat while allowing for continued agricultural production on the remaining portion of the ranch. The Project also includes 400 ac available to develop mixed riparian forest and shaded riverine habitat for mitigating impacts of DWR flood project construction and maintenance.	Implementation date is estimated to be 2015 or later. For more information: http://www.water.ca.gov/floodmgmt/fpo/sgb/fpcp/prop84/comp_sol/2008_selections/alist_projects/knaggs/
North Delta Fish Conservation Bank (The Trust for Public Land and Reclamation District 2093)	Southern Yolo Bypass, Yolo County	An 811-ac bank located on Liberty Island at the southern end of the Yolo Bypass, in the Sacramento-San Joaquin Delta. After implementation the Project would result in the enhancement of over 657 ac of tidal marsh complex, over 68 ac of tidal channel enhancement, and over 32 ac of tidal emergent marsh creation through the removal of levees and lowering a portion of the existing floodplain habitat.	Approved in October, 2013 by the National Marine Fisheries Service (NMFS), U.S. Fish & Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW). For more information: http://www.wildlandsinc.com/wildlands-receives-final-approval-for-mitigation-banks/#sthash.3eR2q00Q.dpuf

Names of Related Projects and Lead Agencies	Location	Brief Descriptions	Status as of October 2015
STRUCTURAL FISH ENHANCEMENT PROJECTS			
Anadromous Fish Screen Program (United Stated Bureau of Reclamation [USBR], United States Fish and Wildlife Service [USFWS], CDFW)	All five Delta counties	Protect juvenile Chinook Salmon (all runs), Steelhead, Green and White Sturgeon, Striped Bass and American Shad from entrainment at priority diversions throughout the Central Valley, including Sacramento and San Joaquin rivers, their tributaries, the Delta, and the Suisun Marsh. The types of projects eligible for cost-share funds under the AFSP include: construction fish screens on unscreened diversions; rehabilitating existing fish screens; replacing existing non-functioning fish screens; and relocating water diversions to less fishery-sensitive areas. Since 1994, the AFSP has screened 35 high priority diversions ranging from 11 cubic feet per second (cfs) up to 960 cfs. Cumulatively, the AFSP has screened over 5,412 cfs in the Central Valley and the Delta.	Ongoing program. For more information: http://www.fws.gov/cno/fisheries/cvpia/AnadromFishScreen.cfm
Fremont Weir Modifications Project (CDFW, DWR, and USBR)	Northern end of Yolo Bypass, Yolo County	Create and manage approximately 21,500 ac of seasonal floodplain habitat. Increase the duration of Yolo Bypass flooding in winter and spring by modifying the Fremont Weir to allow lower-stage flows of the Sacramento River to pass through the Yolo Bypass.	The Fremont Weir Modification Project is part of the Yolo Bypass Fisheries Enhancement Plan, which addresses fish passage improvements mandated by the NMFS BOs RPAs. For more information: http://www.water.ca.gov/fishpassage/projects/yolo.cfm
Lisbon Weir Fish Passage Enhancement (USBR and DWR)	Yolo County	Improve agriculture and habitat water control structure for fish and wildlife benefits.	Project in planning stage. For more information, see pages 19-20 at the following: http://www.water.ca.gov/fishpassage/docs/yolo2.pdf The Lisbon Weir Fish Passage Enhancement is part of the Yolo Bypass Fisheries Enhancement Plan, which addresses fish passage improvements mandated by the NMFS BOs RPAs.
Tule Canal Fish Passage Enhancement (USBR and DWR)	Yolo County	Identify passage impediments and evaluate the feasibility of improving fish passage or removing fish passage impediments.	Project in planning stage. For more information, see page 18 at the following: http://www.water.ca.gov/fishpassage/docs/yolo2.pdf The Tule Canal Fish Passage Enhancement is part of the Yolo Bypass Fisheries Enhancement Plan, which addresses fish passage improvements mandated by the NMFS BOs RPAs.
Yolo Bypass Salmonid Habitat Restoration and Fish Passage (USBR and DWR)	Yolo Bypass, Yolo County (within the Sacramento Valley region)	To create more suitable conditions for fish in the Yolo Bypass and/or lower Sacramento River basin by implementing the Reasonable and Prudent Alternative actions (i.e., I.6.1 and I.7) as described in the 2009 NMFS Biological Opinion and the 2012 Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan. Install an inflatable barrier to induce overbank flooding out of the Tule Canal/Toe Drain or modify the Tule Canal/Toe Drain to create an excavated, shallow flooded region.	Notice of Intent and Notice of Preparation for the Draft EIS/EIR was released on March 4, 2013. Two public scoping meetings were held March 2013 and a Public Scoping Report was released July 2013. Construction planned 2016-2019. For more information: http://www.usbr.gov/mp/BayDeltaOffice/Documents/yolo.html

Names of Related Projects and Lead Agencies	Location	Brief Descriptions	Status as of October 2015
RESOURCE MANAGEMENT PROJECTS AND PROGRAMS			
Aquatic Weed Control Program (California Department of Boating and Waterways [CDBW])	Delta and its tributaries (all five Delta counties)	To implement both short- and long-term measures to control Brazilian waterweed (*Egeria densa*) and water hyacinth (*Eichhornia crassipes*). Beginning in 2001, this weed control program includes treatment with herbicides, environmental monitoring, regulatory compliance, and surveillance. Permits restrict program treatment in the Delta from April 1 through October 15. Since 1982, the water hyacinth program includes treatment with herbicides, mechanical methods, and biological controls. Permits restrict program treatment of chemicals in the Delta from July 1 through October 15. Every season surveys are done in the Delta region to determine where the hyacinth is located and which areas are in most need of treatment. During the 2012 Legislative session, Assembly Bill 1540 (Buchanan) was approved giving the California Department of Boating and Waterways authority to control a new aquatic weed that has been recently found in the Delta, the South American spongeplant (*Limnobium laevigatum*).	A Second Addendum to the Certified 2001 Final EIR was released in 2006 for *Egeria densa*. A Biological Assessment was released in 2013. A Programmatic EIR for the water hyacinth was certified in 2009. A Biological Assessment was released in 2012. For general information about the program: http://dbw.parks.ca.gov/Environmental/Aquatic.aspx For information on use of certain aquatic herbicides: http://www.swrcb.ca.gov/water_issues/programs/npdes/pesticides/weed_control.shtml For the latest reports and document for both species: http://dbw.parks.ca.gov/Reports/Default.aspx#AIS
California Water Fix – Environmental Commitments 3,4,6-12,15,16 and mitigation (DWR and USBR)	All five Delta counties	Based on ongoing review of potential construction and operational impacts, mitigation for California Water Fix construction and operation will include 2,300 ac of habitat restoration and up to 13,300 ac of habitat protection.	The Partially Recirculated Public Draft EIR/Supplemental Draft EIS is available for public review until October 30, 2015. For more information: http://baydeltaconservationplan.com/2015PublicReview/PublicReviewRDEIRSDEIS.aspx
California Eco Restore (Resources Agency)	All five Delta counties	Separate from California WaterFix and over the next 5 years, California will pursue more than 30,000 ac of critical Delta restoration under the California EcoRestore program, pursuant to pre-existing regulatory requirements such as the 2008 and 2009 biological opinions, described below, and various enhancements to improve the overall health of the Delta ecosystem.	Program initiated April 2015. Acreage targets partially met by several projects shown in this table. For more information: http://resources.ca.gov/ecorestore/
Biological Opinions and Conference Opinions on the Long-term Operations of the Central Valley Project and State Water Project for Delta Smelt and Salmonids (USFWS 2008 and NMFS 2009a)	All five Delta counties	Issuance of final biological opinions by each regulatory agency with findings that continued operations of the Central Valley Project (CVP) and the State Water Project (SWP) would likely jeopardize several listed species, including the delta smelt and salmonids. These agencies identified reasonable and prudent alternatives that, if implemented, would avoid the likelihood of jeopardizing the continued existence of those listed species. Included in these opinions are actions such as the restoration of 8,000 ac of land to intertidal habitat and associated subtidal habitat for delta smelt and 17,000 to 20,000 ac of seasonal floodplain for salmonids.	Program is ongoing. The Proposed Prospect would partially fulfill that state and federal requirement. Go to the USFWS and NMFS websites: http://www.fws.gov/sfbaydelta/cvp-swp/cvp-swp.cfm and http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html
Delta Smelt Permanent Refuge (University of California at Davis, DWR, CDFG, USFWS, USBR)	Possibly in Rio Vista, Solano County	Create a permanent facility, possibly at the proposed USFWS Science Center in Rio Vista to provide delta smelt refugia to ensure the conservation of the genetic diversity of delta smelt.	Program under development. See pages 3D-06 and 3D-103 at the following: http://baydeltaconservationplan.com/RDEIRS/Ap_A_Rev_DEIR-S/App_3D_ExistCon.pdf
FLOOD PROTECTION, WATER SUPPLY, AND NAVIGATION PROJECTS AND PROGRAMS			
California Water Fix – Water Conveyance (DWR and USBR)	All five Delta Counties	The proposed conveyance project includes the following: (1) the construction of water intake facilities with a total capacity of 9,000 cfs; (2) operations that would be phased in over several years; and (3) a conveyance system including two tunnels designed to use gravity flow. The existing SWP and CVP south Delta pumping facilities would remain.	The Partially Recirculated Public Draft EIR/ Supplemental Draft EIS available for public review until October 30, 2015. For more information: http://baydeltaconservationplan.com/2015PublicReview/PublicReviewRDEIRSDEIS.aspx

Names of Related Projects and Lead Agencies	Location	Brief Descriptions	Status as of October 2015
Central Valley Flood Protection Plan – 2012 (DWR and Central Valley Flood Protection Board [CVFPB])	All five Delta Counties	Guide California's participation (and influence federal and local participation) in managing flood risk along the Sacramento and San Joaquin rivers' systems. The Plan is a system-wide investment approach for sustainable, integrated flood management in areas currently protected by facilities of the State Plan of Flood Control (SPFC). One proposal under consideration is to widen and improve Fremont Weir in Yolo County.	The Final Program EIR was certified and the plan was adopted in June 2012. The environmental documentation and technical studies are at: http://www.water.ca.gov/cvfmp/documents.cfm Orientation briefings are scheduled in the latter part of March 2013 to discuss the Basin-Wide Feasibility Studies and the Conservation Strategy. For updated information: http://www.water.ca.gov/cvfmp
Davis-Woodland Water Supply Project (City of Davis, City of Woodland, and University of California at Davis)	East-central portion of Yolo County	Divert up to about 45,000 ac-ft annually of surface water from the Sacramento River and convey it for treatment and subsequent use in the cities of Davis and Woodland and the University of California at Davis campus. Project activities include construction and operation of a water intake/diversion, conveyance, and water treatment facilities. Water rights were granted in March 2011, subject to conditions imposed by the state. Water diversions would be limited during summer and other dry periods. A more senior water right for 10,000 ac-ft was purchased from the Conaway Preservation Group to provide summer water supply. Groundwater would continue to be used by Woodland and Davis during when demand for water cannot be met with surface water supplies alone.	The Final EIR was certified in 2009. Construction is scheduled to start April 2014, and expected to be operational by the end of 2016. For more information: http://www.wdcwa.com/the_project
North Bay Aqueduct Alternative Intake Project (DWR)	Solano and Yolo counties	Construct and operate an alternative intake on the Sacramento River, generally upstream of the Sacramento Regional Wastewater Treatment Plant in Freeport, and connect it to the existing North Bay Aqueduct (NBA) system by a new segment of pipe. The proposed alternative intake would be operated in conjunction with the existing NBA intake at Barker Slough. The Project would be designed to improve water quality and to provide reliable deliveries of SWP supplies to its contractors, the Solano County Water Agency and the Napa County Flood Control and Water Conservation District.	The Notice of Preparation for the EIR was published on November 24, 2009. Release of the Draft EIR is still pending. Start of construction is unknown at this time. For more information: http://www.water.ca.gov/engineering/Projects/Current/NBA/
Southport Sacramento River Early Implementation Project (USACE and West Sacramento Area Flood Control Agency)	Yolo County	Implement flood risk-reduction measures along the Sacramento River South Levee in the city of West Sacramento. The Project reach extends along the right (west) bank of the Sacramento River south of the Barge Canal downstream approximately 6.4 miles to the South Cross Levee, protecting the Southport community of West Sacramento. The 3.3-square mile study area encompasses the area of levee improvement along the river corridor and the potential soil borrow sites east and west of southern Jefferson Blvd.	A Notice of Preparation for an EIS/EIR was originally released on August 26, 2011. A revised Notice of Preparation/Notice of Intent due to changes in the preferred alternative was posted on March 8, 2013 and March 15, 2013, respectively, with comments due on April 8, 2013. Certification of the Final EIS/EIR is anticipated for late 2013. Construction is scheduled for some time between 2014 and 2015. For more information: http://cityofwestsacramento.org/city/flood/southport_EIP/default.asp
Sacramento River Deep Water Ship Channel (SRDWSC) Project (USACE and Port of West Sacramento)	Within the Sacramento River Deep Water Ship Channel ,Yolo, Solano, Sacramento, Contra Costa counties	Improve the navigation of the 46.5-mile shipping channel via dredging and establishing wetland/riparian habitat on lower Sherman Island. Would involve both deepening portions of the SRDWSC to a depth of -35 ft MLLW and selective widening from River Miles (RMs) 0.0 to 35.0, completing the construction that was suspended in 1990, and conducting maintenance dredging from RMs 35.0 to 43.4. This Project would involve the excavation and disposal of between 8.1 and 10 mcy of material. The dredging is proposed for six month windows (June 1 –December 31) over four years.	The Draft Supplemental EIS/EIR was released on February 25, 2011 for a public review period that ended on April 18, 2011. The Draft Supplemental EIS/EIR is available here: http://www.sacramentoshipchannel.org/. A Limited Reevaluation Report (LRR) and Final Supplemental EIS/EIR are being prepared, but currently on hold. For more information: http://www.spn.usace.army.mil/Missions/ProjectsandPrograms/ProjectsAZ/SacramentoRiverDeepWaterShipChannel(C).aspx

This table originated in the Lower Yolo Tidal Restoration Project Final EIR (July 2013). All projects in the source document were reviewed for current status. Projects were removed from the list if they have been implemented or if they have no potential cumulative impacts. This table includes public agency and private projects that may require public agency approvals.

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3.19.3 Summary of cumulative impacts

Cumulative impacts of the Proposed Project plus other projects listed in Table 3.19-1 have been assessed by the technical experts preparing each section of this EIR. The overall significance of the cumulative impacts is evaluated and the significance of the Proposed Project's contribution to any potentially significant cumulative impacts is then considered. Mitigation measures for any cumulatively considerable Proposed Project contributions to cumulative impacts are identified.

Hydrology

The Proposed Project would have no impact on the Sacramento River Flood Control Project and the Yolo Bypass Floodway flood conveyance; compliance with D-1641 flow requirements on the Sacramento River at Rio Vista; stability of nearby bridges, trestles, culverts or other structures; or water rights from diversion of surface water. Therefore, the Proposed Project would not contribute cumulatively to any impacts to these resources.

No planned projects or future restoration project opportunity areas considered in the analysis of potential cumulative effects have the potential to increase flows or velocities in Miner Slough. Therefore, there would be no cumulative impacts associated with potential Miner Slough bed scour and/or groundwater seepage on adjacent lands.

Localized tide range impacts of the Proposed Project have the potential to effect the design capacity of agricultural water supply pumps. As discussed in Section 3.1-1, conceptual Phase 1 modeling predicted generally low tidal range reductions for all modeled alternatives, which diminish with distance from Prospect Island. The relatively small tidal restoration footprints of two nearby projects, the North Delta Fish Conservation Bank (32 ac) and the Calhoun Cut Tidal Habitat Enhancement Project (165 ac) (Table 3.19-1), are expected to produce only small, localized reductions in tide range as compared with the Proposed Project. Therefore, the combined cumulative impacts of these two small projects in conjunction with the Proposed Project would be less than significant.

In addition, the larger Lower Yolo Ranch Tidal Restoration Project (1,100 ac) would not have impacts that overlap the Proposed Project's effects on agricultural irrigation and drainage infrastructure (SFCWA 2013). Currently, no other planned projects in the vicinity of Prospect Island are expected to reduce local tide ranges. Therefore there would not be any cumulative impacts to local agricultural water supply and drainage.

On a regional scale, future tidal habitat restoration projects, including the Proposed Project, would cumulatively dampen tide ranges (i.e., decrease the heights of high tides and increase the heights of low tides) in the Delta within the larger context of external processes including seasonal and event-based climatic variability, El Niño/La Niña cycles, storm flows throughout the estuary watershed, changes in Delta water operations, and sea level rise. Projected regional increases in mean sea level would increase regional flood risk by increasing the frequency, intensity, and duration of extreme water levels (Ekstrom and Moser 2012).

Future tidal habitat restoration projects that may be planned for California Water Fix and in nearby EcoRestore project areas could increase the tidal prism and further reduce the tidal range in the Proposed Project vicinity. Thus, overall, the Proposed Project and other tidal habitat restoration projects in the Delta have the potential to reduce flood risks associated with projected increases in regional mean sea level by decreasing water surface elevations during high tides. This would be a beneficial effect.

Water quality

The Proposed Project with Mitigation Measures 3.2-1.1 through 3.2-1.3, 3.2-2.1, and 3.2-3.1 and 3.2-3.2, would have a less-than-significant impact on short-term construction-related effects on water quality due to potential releases of turbidity and pollutants or releases of aquatic-approved herbicides. There would be a less-than-significant impact with respect to water temperature. These impacts would occur on or immediately adjacent to the Project site. Other related projects in the vicinity of Prospect Island (e.g., North Delta Fish Conservation Bank, 32 ac; Lindsey Slough Freshwater Tidal Marsh Enhancement Project, 165 ac; Lower Yolo Ranch Tidal Restoration Project, 1,100 ac) (Table 3.19-1) would be subject to the same stringent requirements to avoid impacts to water quality during construction activities, regardless of whether they overlap in time with construction activities at Prospect Island. Therefore, the cumulative impact of the Proposed Project and other related Delta projects would not be significant with respect to short-term construction-related increases in turbidity, contaminants, herbicides, and water temperature.

Salinity

Combined, the Proposed Project, other tidal restoration projects in the Delta (Table 3.19-1), and projected regional mean sea level rise, have the potential to change the long-term hydrodynamics of the San Francisco Estuary and Delta such that salinity may extend further inland. The Proposed Project would result in minor increases (i.e., less than 1% of baseline EC) in salinity under dry and below normal hydrologic conditions (i.e., worst case scenario) at the majority of the D-1641 compliance monitoring stations considered for the CEQA analysis (Impact 3.2-5). At a small number of stations, modeled salinity increases were greater, with a maximum increase of approximately 5% EC in 2009 (dry water year type) at D-1641 compliance monitoring station D29, located on the San Joaquin River to the south and east of the Project site. These results did not result in non-compliance with D-1641 salinity standards, therefore, this would be a less than significant long-term effect.

Planned tidal restoration projects (Table 3.19-1) along with regional mean sea level rise projections have the potential to change the hydrodynamics of the Delta such that salinity may extend further inland. However, modeling conducted for California Water Fix effects analyses indicates that as Delta outflows decrease, the effect of regional mean sea level rise and tidal habitat restoration on increasing salinity becomes more prominent. At lower outflows, the combined effect of the Proposed Project in combination with other planned tidal habitat restoration projects on salinity in the Delta would be potentially significant. However, D-1641 compliance would still be required in lower outflow years, minimizing the potential significance of this impact.

The incremental effect of increased tidal prism by the Proposed Project would result in a maximum increase of approximately 30 uS/cm as compared to modeled baseline conditions (see Impact 3.2-5). Assuming that D-1641 would still be in place, DWR would be required to comply with salinity standards, which would mitigate for this potential impact. Therefore, the projected incremental effect on salinity due to the Proposed Project would not be cumulatively considerable.

Dissolved organic carbon

Combined, the Proposed Project and other wetland restoration projects in the Delta (Table 3.19 1) have the potential to increase beneficial levels of on-site primary productivity. At the same time, increased algal production as well as plant productivity in these projects have the potential to export dissolved organic carbon (DOC) to Delta waterways. Among other factors, increased DOC levels would be potentially problematic for water treatment facilities with intakes in the Delta, due to the formation of carcinogenic disinfection by-products during chlorination. Although changes in primary productivity and DOC export were not explicitly modeled for California Water Fix, the combined effect of the Proposed Project in combination with other planned tidal habitat restoration projects on DOC in the Delta would be potentially significant. However, the Proposed Project would have relatively small potential for increased DOC export from the Project site that could be transported to municipal drinking water intakes (Impact 3.2-7). Therefore, the incremental effect on DOC due to the Proposed Project would not be cumulatively considerable.

Methylmercury

The Proposed Project would slightly increase the area of infrequently flooded habitat between MHW and MHHW along the interior of the Prospect Island perimeter levees, which would potentially result in increased methylmercury production compared with existing conditions. This increase would be partially offset by increases in open water habitat associated with relatively low production and bioaccumulation potential under the Proposed Project. Given scientific uncertainty regarding the degree to which freshwater tidal wetlands contribute to Delta methylmercury loading now and in the future, ongoing DWR and CDFW mercury compliance control studies, and the small degree of anticipated increased methylmercury production, this would be a less than significant impact (Impact 3.2-8).

While other planned tidal restoration projects in the Delta may further increase the area of infrequently flooded habitat associated with higher methylmercury production, many of these (e.g., Dutch Slough Tidal Marsh Restoration Project, Lower Putah Creek Realignment Project, Lower Yolo Wetland Restoration Project, North Delta Flood Control and Ecosystem Restoration Project [McCormack-Williamson Tract]) are located in the northern Delta and would thus be freshwater tidal restoration projects, subject to the same scientific uncertainty regarding the degree to which these wetlands may or may not contribute to Delta methylmercury loading now and in the future. Others are located further south and west, in or near Suisin Marsh (e.g., Tule Red Enhancement, Overlook Club Wetland Restoration Project, Hill Slough Restoration Project), and thus would be brackish tidal marsh projects. The latter are better represented in the scientific literature regarding the potential for increased methylmercury production and bioaccumulation, however there is still general uncertainty regarding possible methylmercury impacts from these types of projects at the broader scale of the Delta.

When combined with other related projects in the Delta, many of which would also be freshwater tidal restoration projects, the small degree of anticipated increased methylmercury production as a result of the Proposed Project would have a less-than-significant cumulative impact on water quality. No mitigation measures would be required

Aquatic biological resources

The most substantial restorations that have occurred in the Proposed Project region resulted from the natural levee failures of Little Holland Tract (~1,500 ac) and Liberty Island (more than 4,300 ac), both West of the Project site. Northwest of the Project site are the 185 ac Liberty Island Conservation Bank, the 1,226-ac Lower Yolo Ranch Project and the 1,700-ac Liberty Farms Project. These projects, in addition to other Delta projects listed in Table 3.19-1, were evaluated for cumulative impacts to aquatic biological resources.

The Proposed Project would have beneficial long-term impacts to special-status fish, essential fish habitat, and critical habitat. The completed Proposed Project would result in the creation of 462 ac of tidal perennial aquatic habitat and 1,053 ac of tidal wetland habitat (Table 2.2-2) by reconnecting Prospect Island to to tidal action and establishment of intertidal habitat features.

The Proposed Project would have short-term construction-related impacts to special-status fish and fish habitat. However, there would be no significant overlap in time and space of construction-related impacts to special-status fish and habitat between the Proposed Project and other cumulative projects. Therefore, the Proposed Project would not contribute to cumulative construction-related impacts to aquatic resources.

In the long-term, although some projects (e.g., North Delta Flood Control and Ecosystem Restoration Project [McCormack-Williamson Tract], Davis-Woodland Water Supply Project) may result in a loss of aquatic habitat or significant long term impacts to special-status fish, many other restoration projects and the Proposed Project would have beneficial impacts, resulting in an overall net benefit to fish and fish habitat. Therefore, the Proposed Project would not contribute to any long-term cumulative impacts to aquatic biological resources.

Wetland and terrestrial biological resources

The completed Proposed Project would result in the creation of 462 ac of tidal perennial aquatic (open water) habitat and 1,053 ac of tidal wetland habitat (Table 2.2-2) by reconnecting Prospect Island to tidal action and establishment of intertidal habitat features. While there would be potential short-term construction-related impacts to sensitive and special-status wetland and terrestrial plants and wildlife and their habitat, these impacts would not overlap in space and time with short-term impacts of other tidal wetland restoration projects, resource management programs, or flood protection, water supply, and navigation projects (Table 3.19-1). Therefore, the Proposed Project would not contribute to cumulative construction-related impacts for wetland and terrestrial resources.

In the long-term, the conversion of perennial aquatic habitats and wetland communities to tidal habitat types would have a less than significant impact on special-status plant species adapted to current conditions. Since the Proposed Project along with other tidal wetland restoration projects (e.g., Lindsey Slough Freshwater Tidal Marsh Enhancement Project, Dutch Slough, Lower Yolo) would partially restore the historical pre-reclamation tidal regime and potentially support small numbers of giant garter snakes in a Delta location where populations of this snake are not currently found, overall there would not be a cumulatively significant impact. Increased tidal inundation of low lying riparian habitats under the Proposed Project and other tidal wetland restoration projects may result in reduced availability of mature trees suitable for nesting and roosting habitat by western red bat and special-status and migratory birds. This would potentially contribute to long-term cumulative impacts to these species. However, the combined impact would not be cumulatively considerable due to preserved riparian habitat and riparian plantings at the Project site, as well as the availability of other suitable riparian habitats along channel margins in the Proposed Project vicinity.

Further, while other Delta restoration and resource management projects (e.g., North Delta Flood Control and Ecosystem Restoration Project [McCormack-Williamson Tract], Davis-Woodland Water Supply Project) may result in a loss of habitat or significant long term impacts to wetland and terrestrial resources, the Proposed Project would beneficially offset these impacts through the creation of high-quality habitat for numerous wetland and terrestrial species (e.g., valley elderberry longhorn beetle, western pond turtle, nesting and foraging birds that use tidal freshwater emergent habitat). Overall, the Proposed Project would not contribute to long-term cumulative impacts to wetland and terrestrial biological resources.

Geology and soils

The Proposed Project would not contribute to long-term exposure of people and structures to seismic- and landslide-related hazards or sediment erosion in the Proposed Project vicinity.

Modeling conducted to assess the potential effects of the Prospect Island Tidal Habitat Restoration Project on sediment transport and turbidity in the Proposed Project vicinity indicated that the Proposed Project would accumulate sediment under existing sediment supply conditions, with deeper areas of the Project site accreting more rapidly than those at higher elevations (Impact 3.5-2). At a regional scale, current observations suggest a decreasing trajectory of sediment supply to the Delta over time, due to diminishment of the legacy hydraulic mining sediment pulse, deposition in flood bypasses, erosion protection (hardening) of river banks, as well as sediment trapping behind upstream dams (Schoellhamer et. al. 2012, Schoellhamer 2011). However, historical Delta landscapes were built from both inorganic sediment accumulation and organic (peat) accumulation (Whipple et al. 2012), with plant litter providing a much larger contribution to vertical accretion in freshwater marshes than inorganic sedimentation (Schoellhamer et al. 2012). The Proposed Project along with future tidal habitat restoration projects are expected to support sediment accretion as well as peat soil accumulation to help reverse existing land subsidence, offset future subsidence, and promote system resiliency to mean sea level rise throughout the Delta (see also Section 3.19.3 Summary of cumulative impacts: Climate change resiliency). This would be a cumulatively beneficial effect.

Hazards and hazardous materials

If encountered, hazards and hazardous materials would be removed from the Project site or reduced to less than significant levels, which would also eliminate the potential for it to contribute to cumulative hazards. Furthermore, implementation of the Proposed Project does not include any features that would be considered a hazard or create a hazardous condition. As a result, the Proposed Project would not contribute to any potentially significant cumulative impacts associated with health or safety issues.

Air quality

The impacts to the air quality pollutants are inherently of a cumulative nature. There are two groups of air pollutants and their cumulative impacts would be discussed separately.

The first group includes ROG and NO_x, the precursors of ozone. The SVAB was designated as non-attainment for ROG and NO_x, therefore these pollutants are of regional concern. ROG and NO_x emissions from a single project are unlikely to raise the ozone concentration to levels that exceed the state and federal ozone AAQS. Instead, a project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects. YSAQMD and other air districts in the region prepared air quality plans, such as the Regional Ozone Plan, that address attainment of the state and federal ozone AAQS. These plans accommodate cumulative growth by projecting growth in ozone precursor emissions based on different indicators. Through the air quality planning process, ozone precursor emission growth is offset by regional controls on stationary, area, and transportation sources of air pollution. The project-level thresholds for ROG and NO_x were established to be consistent with the air quality plans. A project with ROG and NOx below the YSAQMD threshold would be considered to have less than significant cumulative impacts on regional air quality. Accordingly, a project with ROG or NOx emissions that exceed the YSAQMD threshold would be considered to have significant cumulative impacts. As discussed in Impact 3.7-1, the Proposed Project would generate annual NOx emissions exceeding the 10-ton-per-year YSAQMD threshold and would thus have a significant cumulative impact with respect to NO_x.

The second group of pollutants includes those with localized health impacts caused by the exposure of sensitive receptors to high concentrations of such pollutants. The pollutants in this category include Particulate Matter (PM_{10} and $PM_{2.5}$) and CO. Construction of the Proposed Project would generate emissions in a rural and agriculture area with few sensitive receptors in the close vicinity. PM_{10} emissions (mostly fugitive dust) would not be high in an area currently under water and surrounded by open waters, and the estimated PM_{10} emissions would be below the YSAQMD threshold. CO emissions would be primarily due to construction equipment. All of the projected air pollutant emissions would occur within a construction zone of approximately 200 ac. In addition, no other projects would be carried out within the same timeframe in the vicinity of, or at, the Project site; therefore, Proposed Project and cumulative emissions would be highly unlikely to form hot spots that have localized high concentrations thereby exceeding corresponding state and federal AAQS. Transport of construction materials or waste would generate trips on public roads and at public intersections. However, the limited number of trips generated by the Proposed Project would not create CO hot spots at intersections with degraded level of service. Therefore, cumulative impacts associated with these localized air pollutants would be less than significant.

Greenhouse gases

Because global climate change, by its very nature, is a global cumulative impact, an individual project's compliance with a qualifying GHG Reduction Plan may suffice to mitigate the project's incremental contribution to that cumulative impact to a level that is not "cumulatively considerable." (See CEQA Guidelines, Section 15064, subd. (h)(3).)

Based on the analysis provided in the GGERP and the demonstration that the Proposed Project is consistent with the GGERP (as shown in the attached Consistency Determination Checklist), DWR as the lead agency has determined that the Proposed Project's incremental contribution to the cumulative impact of increasing atmospheric levels of GHGs is less than cumulatively considerable and, therefore, less than significant.

Mineral resources

The Proposed Project would have no impact on mineral resources (Section 3.9.3 Mineral Resources – Impacts and mitigation). Therefore the Proposed Project would not contribute to any cumulative impacts on mineral resources.

Noise

The Proposed Project would produce variable short-term construction-related noise impacts. While the Proposed Project would require mitigation to ensure that noise levels remain less than significant, Project noise would be highly localized and would not overlap with noise from other planned regional projects. Therefore it would not cumulatively add to other noise sources. Additionally, other projects in the vicinity are not located near enough to Prospect Island to produce additive noise impacts. Therefore, the Proposed Project would not contribute to cumulative noise impacts on sensitive receptors.

Aesthetics

The Proposed Project would result in small long-term changes to the visual quality of the site and area as viewed by the public. Because of the site's low-lying location and surrounding levees, project changes would be minimally visible in the context of views of the regional landscape. Therefore it would not contribute considerably to any substantial changes to regional visual character or quality as a result of the cumulative projects.

Agricultural resources

The Proposed Project's conversion of 17.7 ac of agricultural land within the Project site north of the northern cross levee would have a minimal (i.e., not cumulatively considerable) impact on agricultural lands because it would not represent conversion of Prime, Unique, or Important Agricultural Land and it would be only a very small portion of total local agricultural lands (<0.5%) (Impact 3.12-1). Therefore, the Proposed Project would have a less than significant cumulative impact on the loss or conversion of agricultural lands in the Delta.

Cultural resources

The Proposed Project would not result in the destruction of culturally important resources, archaeological resources, historically significant structures, shipwrecks, or paleontological resources. Additionally, the Prospect Island levee would not to contribute to impacts on the potential historically significant Sacramento San Joaquin Delta Levee and Flood Control System; therefore, the Proposed Project would not contribute to any cumulative impacts to historical or archaeological resources.

Land use and planning/Population and housing

As described in Section 12 Agricultural Resources, proposed cumulative ecosystem restoration projects in the Delta would have a significant impact on land use from conversion of agricultural lands to wetlands. However, because the Proposed Project would not result in the loss or conversion of any viable or designated important agricultural lands to non-agricultural uses, it would not contribute to any changes in land use. Therefore the Proposed Project would have no effect on cumulative changes to land use in the region and no mitigation is required.

Public services

As described above, the Proposed Project's potential impacts to public services would be limited to on-site access issues. Therefore, it would not contribute to any cumulative impacts to services.

Recreation

Temporary construction impacts on recreation would be limited to project activities and not overlap any other projects' impacts on recreation. The Proposed Project would have a long-term positive effect on recreation by providing additional wild lands for recreation access via boat. No contribution to cumulative impacts to regional recreation is anticipated to be caused by project construction, or by post-project conditions.

Transportation and traffic

The Proposed Project would generate small amounts of construction-related traffic, the peaks of which would be concentrated in short periods within the three-year construction window. In addition, most on-road trips would be localized and would occur on lightly used roadways. These peak generation periods are unlikely to overlap with construction traffic impacts from other projects because of their limited duration and localized nature. Therefore, traffic generation from the Proposed Project would not have the potential for cumulatively considerable impacts.

Utilities

The Proposed Project would neither result in the need for additional services from local utility providers, nor result in the temporary disruption of utility services to the providers' customers. As such, the Proposed Project would not generate a cumulative impact as a result of implementation of the Proposed Project on utilities.

Implementation of the Proposed Project would result in an increase in solid waste disposal at regional landfills, and may include the disposal of some hazardous materials. While other regional projects may require the need for solid waste facilities, the Proposed Project is estimated to generate 65,000 cubic yards of debris over the course of construction (2 years), which would equate to less than 22,000 cubic yards per year. In the context of the permitted annual capacity of the region landfills, the Proposed Project would not contribute a cumulatively considerable amount of solid waste in comparison to the amount which is received annually by the regions landfills. As such, the Proposed Project would not have a significant cumulative impact on utilities or services.

Climate change resiliency

The Proposed Project may be impacted by changes in hydrology, increases in air and water temperatures, changes in salinity, and increases in mean sea level rise associated with climate change (see also Section 3.19.3 Summary of cumulative impacts: Hydrology, Water quality, and Geology and soils, above). Since tidal wetlands form at the land-sea interface, they are particularly susceptible to an increase in frequency and duration of inundation resulting from a rise in mean sea levels. Over the long-term, more frequent and longer inundation could contribute to erosion and changes in species composition at the Project site. Depending on the total increase in mean sea level, intertidal habitat could transition to shallow subtidal habitat and shallow subtidal habitat to tidal perennial aquatic habitat (open water). However, while the low elevations (-3 to 8 feet) increase the vulnerability of the Proposed Project to sea level rise, the excavation of the tidal slough channels along with the construction of the toe berm, the intertidal bench, and the internal topographic features would increase both sedimentation and marsh development at rates that may allow the Project site to keep pace with projected increases in regional mean sea level rise for 2050. More specifically, sea level rise projections for 2050 range from 5 to 24 inches, with a mean of 11 inches. Based on the Phase 2 modeling results, the Proposed Project would result in a maximum annual sediment accretion amount on the order of 4 inches. While accretion would be unevenly distributed across the Project site, over time it would presumably help to reverse existing subsidence, offset projected future subsidence (1.6 ft by 2050; Deverel and Leighton [2010]) and promote resiliency to projected regional mean sea level rise.

Changes in the salinity gradient due to changes in the timing and amount of freshwater runoff and rising sea levels are not expected to affect the species composition at Prospect Island (e.g., a shift of freshwater emergent wetland vegetation to more brackish species). Increased tidal prism due to the Proposed Project would result in a small incremental effect as compared to modeled baseline conditions (see Impact 3.2-5), and assuming that D-1641 would still be in place, DWR would be required to comply with salinity standards, which would mitigate for any changes in the salinity gradient at the Project site.

Overall, the Proposed Project along with future tidal habitat restoration projects are expected to contribute to greater regional climate change resiliency by supporting sediment accretion and peat soil accumulation to help reverse existing land subsidence and offset future subsidence, increasing the amount of wetland and riparian habitat, providing temperature refugia for native aquatic species, storing riverine floodwater, and dampening storm surges. This would be a cumulatively beneficial effect.

3.20 Other CEQA Considerations

3.20.1 Growth inducement

CEQA requirements for evaluation of growth-inducing impacts are set forth in Section 15126.2 (d) of the CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387). CEQA requires that both direct and indirect impacts of all phases of a Proposed Project be considered. Growth-inducement is typically considered to be a direct or indirect effect of an action that either directly fosters growth or removes an obstacle to economic or population growth, or the construction of new housing. The CEQA Guidelines also require evaluation of new infrastructure and service facilities needed to serve growth induced by a project. The Guidelines note that “it must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment”. Therefore, the nature of the effects of any induced growth also must be considered to determine if the impacts of that growth are potentially significant.

Some projects may be considered growth inducing while others may be growth accommodating (i.e. they are intended to accommodate planned growth, but do not induce that growth). The distinction here is primarily whether or not a project removes an obstacle to growth. It is sometimes argued that, if growth is already planned for in a jurisdiction’s General Plan, then infrastructure supporting that development is growth accommodating rather than growth inducing. However, CEQA is concerned with on-the-ground impacts to the environment. Therefore, if planned development cannot move forward absent a particular infrastructure project, or the development is substantially encouraged by that infrastructure, that project is generally considered growth inducing.

The CEQA Guidelines also state (Section 16064 (d)(3) that an indirect physical change is to be considered only if that change is “a reasonably foreseeable impact which may be caused by the project. A change which is speculative or unlikely to occur is not reasonably foreseeable”.

The Proposed Project involves tidal habitat restoration, which would not have any affect on growth, as it would not provide any new housing, infrastructure, or economic activity. It also would no remove any obstacles to growth, expand infrastructure, or develop economic activity other than short-term employment for a small number of local workers in constructing the Proposed Project. Therefore, this impact would be less than significant.

3.20.2 Significant unavoidable adverse impacts

There would be no significant unavoidable adverse impacts due to the Proposed Project or alternatives.

4 ALTERNATIVES

4.1 Introduction

Section 15126(d) of the CEQA Guidelines requires that an EIR describe a range of reasonable alternatives to the Proposed Project, or to the location of the project, which could feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant environmental effects of the Proposed Project. The “rule of reason” governing the range of alternatives specifies that an EIR should only discuss those alternatives necessary to allow a reasoned choice by the decision makers. Alternatives should, if feasible, avoid or substantially lessen one or more of the significant effects of the Proposed Project identified in the EIR. Of those alternatives, an EIR need examine in detail only the ones that could feasibly attain most of the basic objectives of the Proposed Project. Alternatives must be “feasible”, taking into account cost, existing technology, and logistics relative to the Proposed Project’s overall purpose and objectives. The EIR should include sufficient information about each alternative to allow meaningful evaluation, analysis and comparison with the Proposed Project.

The basic objectives of the Proposed Project include (see also Section 1 Introduction):

1. Enhance primary and secondary productivity and food availability for Delta Smelt and other native fishes within Prospect Island and surrounding Delta waterways.
2. Increase the quantity and quality of salmonid rearing habitat within and in the areas surrounding Prospect Island.
3. Increase the amount and quality of habitats to support other listed species, to the extent they can be supported by site conditions and natural processes.
4. Provide other ecosystem benefits associated with increased Delta freshwater tidal marsh habitat, including water quality enhancement, recreation, and carbon sequestration.
5. To the greatest extent practical, promote habitat resiliency to changes in future Delta conditions, such as land use conversions, climate change, sea level rise, and invasive species.
6. Avoid promoting conditions adverse to Proposed Project biological objectives, such as those that would favor establishment or spread of invasive exotic species.

4.2 Development of Alternatives Considered in this EIR

The planning process for the Project used a two-phased evaluation to determine the Proposed Project and alternatives to be carried forward through the CEQA process. Phase 1, completed in fall 2012, involved developing screening criteria and conceptual design alternatives, conducting hydrodynamic modeling, and applying the screening criteria to evaluate those conceptual alternatives. Phase 2, completed in winter 2014, involved applying additional evaluation criteria, refining remaining alternatives, and performing a comparative analysis of these refined alternatives through hydrodynamic modeling and applying Phase 2 evaluation criteria.

4.2.1 Phase 1 screening of conceptual alternatives

In Phase 1, 30 conceptual restoration alternatives were initially developed for the Project. These alternatives involved different breach locations, numbers, and types (i.e., weir vs. breach) (SWS and WWR 2012). These alternatives were examined and compiled into five groups based on similar attributes (such as number, location, and type of breaches). Fifteen restoration alternatives representing these groupings were modeled. The modeling outcomes were compared using hydrodynamic modeling metrics to represent the following screening criteria:

- Phytoplankton production within the restoration site
- Tidal mixing of exported productivity
- DOC impacts at Barker Slough Pumping Plant
- Flood conveyance impacts on the Yolo Bypass
- Flood conveyance impacts on Miner Slough
- Reduction of tidal range
- Velocity cross currents in the DWSC
- Scour potential to Ryer Island Miner Slough levee

Based upon the similarity of modeling results amongst conceptual restoration alternatives, only the productivity criterion provided a key distinction between alternatives by meeting restoration objectives. Phase 1 modeling results for the remaining criteria above were used in assessing Project effects under CEQA.

4.2.2 DRERIP technical review, October 2012

In October 2012, the CDFW Ecosystem Restoration Program convened a technical review utilizing the Delta Regional Ecosystem Restoration

Implementation Plan (DRERIP) evaluation process, for the purpose of providing guidance on alternatives to carry forward into the second phase of restoration planning. This effort recommended a suite of alternatives focused upon high degrees of tidal connectivity. Its final report was completed in February 2013.

4.2.3 Phase 2 screening of conceptual alternatives

In Phase 2, the performance of alternative Project configurations with breaches only on Miner Slough were reexamined considering Phase 1 and supplemental modeling results, effects on property access, and outcomes in the DRERIP evaluation process (WWR and SWS 2014). Consideration was also given to the question of whether DWSC breaches may be added to the Project in the future, and how this action might affect Project outcomes. Based on this refined selection process, nine alternatives were selected for Phase 2 modeling and analysis and three of these alternatives were also used in sensitivity modeling to compare extent of constructed channels and emergent vegetation. The modeling outcomes were compared using the evaluation criteria, which included:

- Phytoplankton production within the restoration site
- Tidal mixing of exported productivity
- Temperature changes in adjacent water bodies
- Turbidity in the Cache Slough region
- Salinity changes at the D-1641 compliance stations
- Regional flow alterations

4.2.4 Selection of Proposed Project and EIR alternatives

Using the results from this screening, the Project Management Team met on February 10, 2014 to make tentative selections of the Proposed Project and two alternatives and to determine the approaches to the many components of the restoration project, all to be evaluated in the Project EIR. The Proposed Project and CEQA Alternatives were selected by DWR and CDFW FRP staff based on potential to meet Project objectives and potential to reduce or eliminate potential Project impacts. A consensus-based process, with group discussion of the factors above, was employed to select the alternatives. The selected alternatives were further reviewed by a Science Panel on March 4, 2014. That panel concurred that the alternatives were suitable for consideration in the EIR and made recommendations on “fine tuning” some of the restoration components.

4.2.5 Alternatives considered and rejected

Off-site alternatives

DWR obtained ownership of the approximately 1,600-ac site with the intent to develop a habitat restoration project for the purposes of fisheries enhancement. Although other sites in the Delta would be suitable for restoration, the alternatives for this Project were limited to Prospect Island because: (1) DWR already owns the vast majority of the site; (2) Other potential restoration sites in the area would be needed to fulfill the USFWS Delta Smelt Biological Opinion (BiOp) for long-term coordinated operations of the State Water Project (SWP) and the federal Central Valley Project (CVP) (USFWS 2008) and therefore would likely be developed in addition to this site, (3) the site is already designated for wildlife purposes in the Solano County General Plan Land Use Element and is not in other use, therefore restoration on the Island would not displace existing land uses or conflict with those uses; (4) the site's location and elevations make it an ideal restoration candidate; and (5) restoration of the Project site would likely have reduced impacts compared to other, upland, sites because this site is already flooded. Therefore, the alternatives considered in this section are limited to on-site options.

Breaching of the DWSC levee

On April 18, 2013, subsequent to selection of the eight alternatives, a meeting was held with the USACE Sacramento navigation operations office staff to discuss the federal regulatory process for the Project. In this meeting, USACE representatives voiced concerns about Project alternatives that included breaching the DWSC levee. The concern was that wave generation by shipping traffic on the DWSC would enter the restored Prospect Island via the levee breaches, scour sediment from the island interior substrate, and transport that sediment back into the DWSC; that this sediment would then be deposited in the DWSC, increasing the volume and/or frequency of required maintenance dredging. On the basis of this anticipated impact, the USACE representatives indicated that approval of a permit pursuant to the Rivers and Harbors Act of 1899 Section 14 (33 U.S.C.408) (408 permit), which would be required to construct breaches on the DWSC levee, would be extremely unlikely. It was further stressed that the USACE would maintain this position regardless of the level of analysis undertaken by DWR to examine the potential for such impacts.

As a result of the USACE position, DWR and the FRP Project Team made the determination that Project alternatives including DWSC breaches would not be feasible under the timeline of the Project. This determination restricted feasible alternatives to those with breaches along Miner Slough only.

4.3 Alternatives Considered in this EIR

This EIR describes and analyzes the comparative environmental impacts of the following alternatives:

- Alternative 1: No Project
- Alternative 2: Two Breaches and Weir
- Alternative 3: Three Breaches

The major components of the Proposed Project and selected alternatives are compared in Table 4.3-1, and summarized below.

Table 4.3-1. Comparison of Features—Proposed Project and Alternatives

Project Feature	Proposed Project	Alternative 2	Alternative 3
Project extent	North and south properties	Same as Proposed Project	Same as Proposed Project
Levee breaches/ excavation	Northern Miner Slough Southern Miner Slough Internal cross levee	Central Miner Slough Southern Miner Slough Internal cross levee	Northern Miner Slough Central Miner Slough Southern Miner Slough
Levee weir	None	Northern Miner Slough	None
Breach velocity dissipation	Include gentle side slope transition feature at one breach location (TBD)	None	None
Soil disposal and re-use	Re-use all soils excavated on site to construct eastern toe berm, eastern intertidal bench, interior topographic features, and to fill ditches	Same as Proposed Project	Same as Proposed Project
Eastern toe berm	Build toe berm along portions of interior side of Miner Slough levee on north property	Same as Proposed Project at locations not excavated for levee breaches	Same as Proposed Project at locations not excavated for levee breaches
Eastern intertidal bench	Build 'bench' to intertidal elevations in subtidal areas adjacent to Miner Slough levee	Same as Proposed Project with slightly reduced area of eastern intertidal bench at the central Miner Slough levee breach	Same as Proposed Project with slightly reduced area of eastern intertidal bench at the central Miner Slough levee breach

Project Feature	Proposed Project	Alternative 2	Alternative 3
Interior topographic features	Create small, isolated mounds along constructed channel network Top elevations approximately MHHW	Same as Proposed Project	Same as Proposed Project
Planting and revegetation	Upland areas along Miner Slough levee and eastern toe berm: limited planting with native riparian species Eastern intertidal bench: 1) If needed, plant tules in areas subject to wind-wave erosion to augment natural recruitment, but no more than 20' in width. 2) Limited experimental planting (up to 5 ac)	Same as Proposed Project, with slightly reduced area of eastern intertidal bench at the location of the central Miner Slough levee breach	Same as Proposed Project, with slightly reduced area of eastern intertidal bench at the location of the central Miner Slough levee breach

4.4 Alternative 1: No Project

4.4.1 Description

Alternative 1 (not shown) represents the No Project Alternative to be evaluated under CEQA. Under this alternative, current management practices would continue. The USACE would continue to maintain the DWSC levee as a Navigation Project Levee. Ongoing maintenance activities for the DWSC and northern cross levee would include periodic vegetation removal along the levee crown, for both access and levee inspection purposes. Minor and/or emergency levee repairs could require removal of mature riparian vegetation and import and placement of riprap and other fill material.

4.4.2 Environmental impacts

Hydrology

Under the No Project Alternative, the levees surrounding Prospect Island would not be intentionally breached and existing hydrology effects on site conditions would continue. If natural breaches occurred at one or more locations along the Miner Slough levee, either one or both of the properties would become tidally connected to Miner Slough. Future levee repairs would occur only if existing access easements or public safety are affected by the naturally occurring levee breaches. The continuation of existing hydrologic conditions under the No Project Alternative would not impact agricultural water supply and drainage, groundwater seepage to adjacent areas, groundwater supplies and third party wells, and

Miner Slough levee and/or bed scour. Under the No Project Alternative, these impacts would be the same as or less than those of the Proposed Project.

Similar to the Proposed Project, the No Project Alternative would have no impact on compliance with regional D-1641 flow requirements. This alternative also would have no impact on flood conveyance or scour that could impact stability of nearby bridges, trestles, culverts or other structures, and it would not affect water rights due to surface water diversion.

Water quality

Under the No Project Alternative, the levees surrounding Prospect Island would not be intentionally breached and current water quality conditions would persist. There would be no construction activities and therefore no short-term construction-related impacts to water quality from increased turbidity, pollutants, herbicide use, or altered water temperature. The continuation of existing water quality conditions under the No Project Alternative would not impact salinity, water temperature, or DOC in adjacent waterbodies.

Under the No Project Alternative, there would be no impact on methylmercury production, bioaccumulation, or export to surrounding waterways as compared with existing conditions and the Proposed Project, since there would be no change in flooding frequency for the existing perennial emergent marsh and Prospect Island would remain non-tidal.

Similar to the Proposed Project, the No Project Alternative would have no impact on groundwater quality.

Aquatic biological resources

Under the No Project Alternative, there would be no construction activities and therefore no short-term construction-related impacts to aquatic habitat or fish species, including dewatering, turbidity, noise, and herbicide application. Fish currently on Prospect Island, including native species, would remain there, isolated from adjacent waterways. Delta Smelt, Chinook Salmon, and other native fishes would not have access to additional rearing habitat along Miner Slough or benefit from increased food web production in this stretch of the river.

Future levee repairs would occur only if existing access easements or public safety is affected. An unrepaired natural levee failure may result in the continued residency of invasive aquatic plants and fish. Without the design features (i.e., starter channels, channel velocities, invasive species control) inherent to the Proposed Project, special-status fish would not be likely to benefit from the newly connected habitat as much as under the Proposed Project and there could be adverse impacts to special-status fish due to a potential increase in predator habitat on Prospect Island.

Wetland and terrestrial biological resources

Under the No Project Alternative, the levees surrounding Prospect Island would not be intentionally breached and conditions for existing perennial aquatic and wetland communities would continue. No construction would take place under this alternative, therefore, there would be no short-term construction-related impacts to sensitive and/or special-status species or their habitat.

If natural breaches occurred at one or more locations along the Miner Slough levee, either one or both of the properties would become hydrologically connected to Miner Slough. Future levee repairs would occur only if existing access easements or public safety are affected by the naturally occurring levee breaches. Fluctuating hydrology due to repeated breaching and repairs could be more detrimental to wetland-associated sensitive and/or special-status species (e.g., plants, giant garter snake, western pond turtle) than a long-term structured conversion of habitat.

Geology and soils

As is the case for the Proposed Project, under the No Project Alternative, levee repairs are planned for 2016 to remediate zones of the levee that have been identified to be in the most critical condition. Following these repairs, the integrity of the Miner Slough levees would be increased significantly. Under the No Project Alternative, future levee repairs would occur if existing access agreements or public safety is affected by naturally occurring levee breaches. Construction of the Miner Slough levee toe berm would not occur and as a result, overall levee integrity would not be enhanced.

The No Project Alternative would not support inorganic sediment accretion at the Project site since there would be no connection to tidal flows and associated suspended sediments. Because organic (peat) accumulation would continue to occur at the Project site from existing non-tidal emergent marsh habitat, the No Project Alternative would continue to help reverse existing land subsidence and offset future subsidence within Prospect Island (see also Section 3.19.3 Summary of cumulative impacts – Geology and soils). However, since there would be no connection to tidal flows, the No Project Alternative would have no effect on system resiliency to mean sea level rise in the Delta.

Hazards and hazardous materials

Under the No Project Alternative, there would be no construction activities and thus no construction-related impacts due to leaks or spills of hazardous materials. There would be no construction-related disturbance or damage to the abandoned gas wells and/or groundwater monitoring wells at the site.

Remnants of the Prospect Island houses (P-48-000417) located on the north property, including the pump platform, would continue to be a safety concern. The pump lubricant container would still need to be secured and sealed to prevent leakage or over topping. Additionally, Structure P-48-000956 on the south property would continue to pose a potential hazard to public safety under the No Project Alternative. The No Project Alternative would not remove these structures, as would occur under the Proposed Project, and thus these existing hazards would remain.

The No Project Alternative would not reduce conditions favorable to mosquito production on the Project site. Non-tidal freshwater perennial emergent wetland habitat, with vegetation and hydrologic characteristics that can promote mosquito production, would continue to represent the majority of habitat on Prospect Island, and thus this existing hazard would remain.

Air quality

Under the No Project Alternative, there would be no short-term air quality impacts due to Project construction activities. Potential impacts of ongoing maintenance activities for the DWSC and northern cross levees on air quality would be the same as existing conditions.

Greenhouse gases

Under the No Project Alternative, there would be no short-term GHG impacts due to Project construction activities. Potential impacts of ongoing maintenance activities for the DWSC and northern cross levees on GHGs would be the same as existing conditions.

Mineral resources

Under the No Project Alternative, no impacts to mineral rights would occur because there would be no changes to the gas fields underlying portions of the Project site due to activities occurring on Prospect Island, and there are no other locally known mineral resources.

Noise

Under the No Project Alternative, there would be no short-term noise impacts due to Project construction activities. Potential impacts of ongoing maintenance activities for the DWSC and northern cross levees on noise would be the same as existing conditions.

Aesthetics

Under the No Project Alternative, there would be no impacts to existing views or visual quality of the Project site.

Agricultural resources

Under the No Project Alternative, there would be no impacts on agricultural lands. The site would remain flooded and no agricultural uses would occur.

Cultural Resources

Under the No Project Alternative, there would be no impacts to cultural resources including undiscovered cultural resources. The remaining buildings would continue to decompose naturally and the levees would continue to be maintained in their current manner.

Land use and planning/Population and housing

Under the No Project Alternative, no impacts to land use or population/housing would occur because there would be no construction activity or intentional breaching of levees that could potentially affect adjacent land uses, local plans and policies regarding land use, or population and housing. Future levee repairs would occur only if existing access easements or public safety are affected by naturally occurring levee breaches.

Public services

Under the No Project Alternative, there would be no impacts to public services. Existing services and emergency access would continue on Prospect Island. Future levee repairs would occur only if existing access easements or public safety are affected by naturally occurring levee breaches.

Recreation

Under the No Project Alternative, no impacts to recreation would occur because there would be no construction activities or intentional breaching of levees.

Transportation and traffic

Under the No Project Alternative, no impacts to traffic or circulation would occur because there would be no construction activity or intentional breaching of levees. Future levee repairs would occur only if existing access easements or public safety are affected by naturally occurring levee breaches.

Utilities

Under the No Project Alternative, current conditions would remain and no impact to utilities, deeded easements, or solid waste facilities would occur.

4.5 Alternative 2: Two Breaches and Weir

4.5.1 Description

Under Alternative 2, two breaches would be created on the Miner Slough levee: one in the central portion of Prospect Island, just north of the existing internal cross levee, and the second would be constructed at the location of the formerly repaired breach connecting the Miner Slough spur channel to the south property (Figure 4.5-1). In addition, a high stage overflow weir would be constructed with a 7 ft NAVD88 crest elevation near the entrance to Arrowhead Marina near the overflow weir in the far northeast corner of the island. Local levee elevations at the location of the proposed overflow weir are in the 18 ft NAVD88 range, which would translate to approximately 11 ft of levee excavation. Based on physical and hydraulic site conditions at the weir location on an outside bend of Miner Slough, the weir would be approximately 1,000 feet in length. The internal cross levee separating the north and south properties would also be excavated under this alternative. Once breached, the north and south properties would be subject to daily tidal inundation, with periodic overtopping of the weir at high tide during spring tide conditions. The overflow weir would also function during flood flow conditions in Miner Slough. It is possible that acquisition of the privately owned parcel in its entirety along with its legal access rights may be necessary to implement this alternative. Alternatively, the legal access rights to the privately owned parcel may be acquired separate from the property, or legal access to the privately owned parcel may be relocated along Miner Slough over the proposed overflow weir.

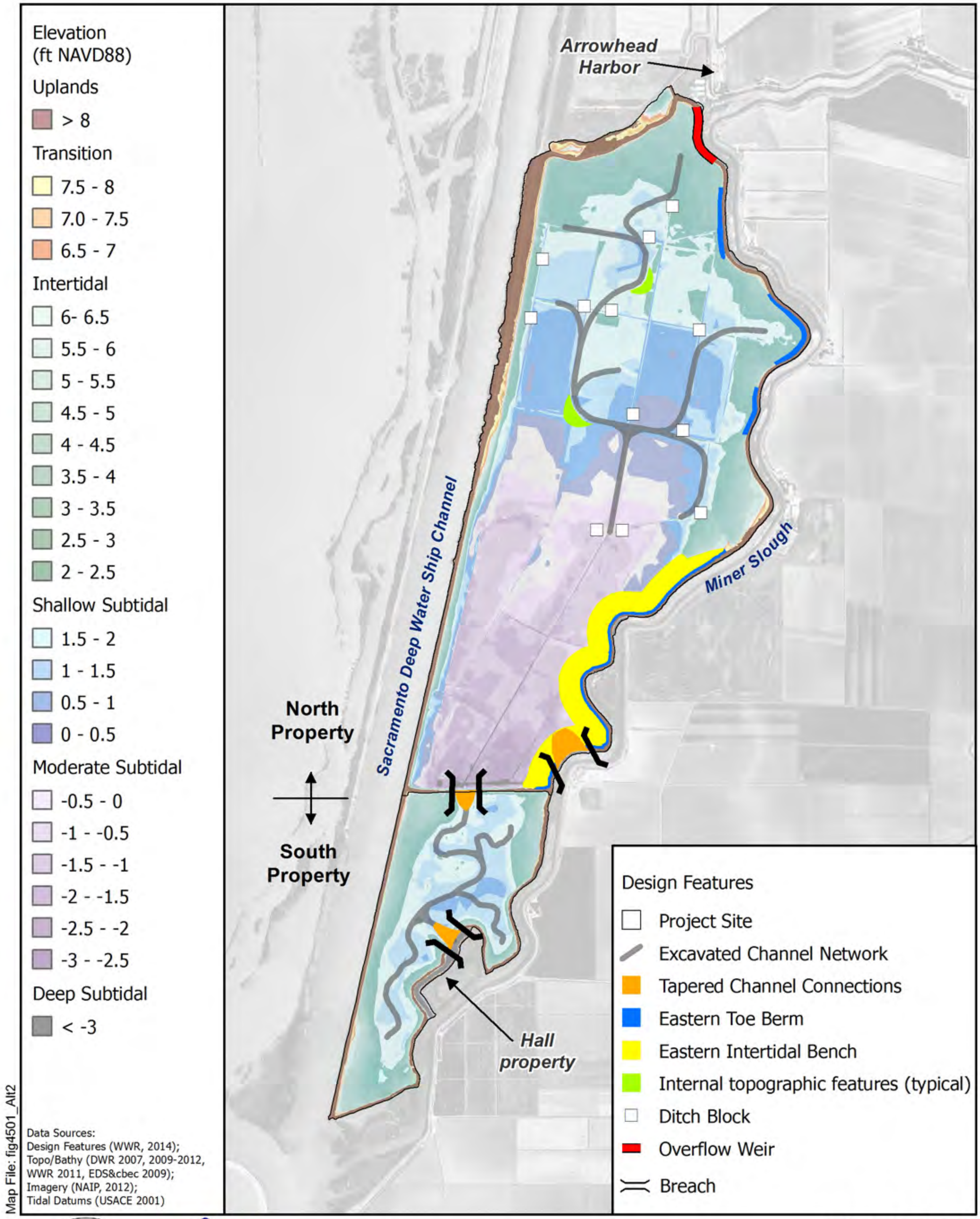

Figure 4.5-1

Restoration Alternative 2

4.5.2 Environmental impacts

Hydrology

Phase1 and Phase 2 hydrodynamic modeling completed during the Prospect Island habitat restoration conceptual planning phase included a variety of configurations with varying numbers and locations of breaches along both Miner Slough and the DWSC (SWS and WWR 2012, WWR and SWS 2014). The Phase 1 model configuration most similar to Alternative 2 to the Proposed Project is “Alt 4.”. Modeling results indicate that potential hydrology impacts to agricultural water supply/drainage and flood conveyance under Alternative 2 would be the same as those described for the Proposed Project.

Phase 1 hydrodynamic modeling indicates that north of the central Miner Slough levee breach, Altermative 2 would result in lower in-channel velocities and reduced potential for bed scour as compared with the Proposed Project. In Miner Slough south of the central breach to the Cache Slough confluence, Alternative 2 would result in similar in-channel velocities as for the Proposed Project.

Existing data indicate that potential impacts due to groundwater seepage to adjacent areas under Alternative 2 would also be the same as the Proposed Project. Similarly, there would be no construction related impacts to groundwater supplies and third party wells under Alternative 2.

Similar to the Proposed Project, Alternative 2 would have no impact on compliance with regional D-1641 flow requirements. This alternative also would have no impact on scour that could impact stability of nearby bridges, trestles, culverts or other structures, and it would not affect water rights due to surface water diversion.

Water quality

The shift in breach location under Alternative 2 would not appreciably alter short-term construction-related impacts to water quality compared to those of the Proposed Project. There would be no dredging under Alternative 2, which would eliminate short-term construction-related increases in turbidity and suspended sediment levels within Miner Slough and in downstream waters due to mechanical dredging of the spur channel. As with the Proposed Project, implementation of Mitigation Measures 3.2-1.1, 3.2-1.2, 3.2-1.3, 3.2-2.1, 3.2-3.1 and 3.2-3.2 would reduce the remaining short-term construction-related impacts of increased turbidity, pollutants, and herbicide use to less than significant.

Phase 1 modeling of DOC and Phase 2 modeling of salinity and water temperature completed during the Prospect Island habitat restoration conceptual planning phase indicate that long-term impacts to salinity, water temperature (Impacts 3.2-5 and 3.2-6) under this alternative would be the same as those under the Proposed Project and would be less than significant for salinity and beneficial for water temperature. With respect to the potential export of DOC (Impact 3.2-7), Alternative 2 would result in lower transport of DOC to surrounding waterways compared to the Proposed Project. Overall, the low level of DOC export to the Delta under Alternative 2 would not result in substantial adverse effects on beneficial uses of water, in particular municipal drinking water supply at the Barker Slough Pumping Plant. This would be a less than significant impact.

As with the Proposed Project, Alternative 2 would convert existing perennially flooded freshwater emergent marsh to tidal freshwater emergent marsh, which may affect the rate of methylmercury production and degree of bioaccumulation in higher trophic level organisms resident at the Project site and may result in subsequent transport of methylmercury to downstream waterbodies. If methylmercury production increases, and depending on the magnitude of the increase, this could result in adverse, few, or no effects on public health or environmental receptors due to elevated methylmercury concentrations in the tissue of fish, birds, mammals, and humans that consume contaminated organisms.

Factors controlling the production and bioaccumulation of methylmercury and its ability to be transported from tidal wetlands into downstream waterbodies are complex and not yet fully understood (see Impact 3.2-8). Based upon the CALFED Science Program Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) conceptual model of methylmercury production, habitat flooding frequency corresponds with a methylmercury gradient, from relatively low methylmercury concentrations in the overlying water column of perennially flooded habitats (e.g., open water areas), low to moderate concentrations in habitats that flood frequently and do not fully dry between inundation events (e.g., low elevation tidal marsh), and potentially higher concentrations in areas that flood less frequently and dry out between inundation events (e.g., seasonal floodplains or wetlands and high elevation tidal marsh) (Alpers et al. 2008).

As with the Proposed Project, restoration of tidal action to the site under Alternative 2 would result in the conversion of existing perennially flooded emergent marsh (i.e., associated with low to moderate methylmercury concentrations) to open water habitat (i.e., associated with low methylmercury concentrations). It is anticipated that the small increase in the area of infrequently flooded habitat between MHW and MHHW on the land-side of the perimeter levees would potentially result in increased methylmercury production. However, the increase in methylmercury production would be partially offset by the increases in open water habitat associated with lower production and bioaccumulation potential. Because the Project site would be open to tidal action, any methylmercury produced in the infrequently flooded habitat would be exported to surrounding waterways. With respect to the potential export of methylmercury, Alternative 2 would result in lower transport to surrounding waterways compared to the Proposed Project due to the shift in breach location and infrequent activation of the weir at the northern end of Prospect Island.

Given scientific uncertainty regarding the degree to which freshwater tidal wetlands contribute to Delta methylmercury loading now and in the future (see also Impact 3.2-8), ongoing DWR and CDFW mercury compliance control studies (see also Impact 3.2-8), and the small degree of anticipated production under Alternative 2, this would be a less than significant impact. As with the Proposed Project, Alternative 2 would have no impact on groundwater quality.

Aquatic biological resources

Under Alternative 2, the northern Miner Slough breach would be replaced with an overflow weir, a central Miner Slough breach would be located on the north property just past the internal cross levee, and the south Miner Slough breach would be located at the end of the Miner Slough spur channel (Figure 4.5-1). The weir is designed to regularly overtop during high flow events thereby maintaining access for juvenile salmonids and other fish species (DWR and CDFW 2014). Overall, the acreage and quality of habitat would remain similar to the Proposed Project. Although higher than under existing conditons, the potential for food export to other habitat within the Cache Slough Complex would be somewhat lower than with the Proposed Project, but originating from a broader range of residence times associated with beneficial algal production (WWR-Stillwater Sciences 2014).

The weir would require about 1,000 linear feet of rock slope armoring on the Miner Slough side of the weir as well as small amounts at the breach transitions into the interior of Prosepect Island. This would be a relatively small portion of the 5.2-mile Miner Slough levee and would be self-mitigated by the channel margin and shaded riverine aquatic habitat created by tidally connecting Prospect Island to Miner Slough.

Under Alternative 2, dredging of the Miner Slough spur channel would not be necessary, with similar potential for short-term impacts related to the temporary repair of the south property levee (Impact 3.3-1). Impact 3.3-5 would not occur and impacts 3.3-3, 3.3-4, and 3.3-6 would be reduced. The mitigation associated with Impact 3.3-6 would still be necessary. Lastly, potential fish injury or mortality impacts due site dewatering and herbicide application (Impacts 3.3-7 and 3.3-8) would be the same as the Proposed Project and implementation of the associated mitigation measures (3.3-7.1, 3.2-3.1, and 3.2-3.2) would reduce these impacts to less than significant.

Without the levee breach on the south property, the temporary levee at this location would be permanently repaired and a small amount (<0.1 ac) of aquatic habitat would be lost as a result of the repair. There would be no additional impacts under Alternative 2 relative to the Proposed Project and impacts to aquatic biological resources would remain less than significant.

Wetland and terrestrial biological resources

Short-term impacts to perennial aquatic habitats and wetland communities from site preparation under Alternative 2 would be the same as those of the Proposed Project (see Impact 3.4-1). These impacts would be significant and unavoidable. There would be no short-term impacts to tidal tidal aquatic habitats and wetland communities in the Miner Slough spur channel (see Impact 3.4-2), since dredging of the spur channel would not occur under Alternative 2. There would be a small increase (approximately 1 ac) in riparian clearing at the weir location under Alternative 2, such that short-term loss of valley/foothill riparian habitat would increase from 19 ac under the Proposed Project (see Impact 3.4-3) to approximately 20 ac under Alternative 2. Accordingly, short-term construction-related mortality or detrimental effects to sensitive plants would also increase slightly (see Impact 3.4-4). Implementation of mitigation measures 3.4-3.1 and 3.4-4.1 would reduce these impacts to less than significant.

Long-term conversion of perennial aquatic habitats and wetland communities to tidal habitat types under Alternative 2 would be the similar to that of the Proposed Project, with permanent conversion of up to approximately 340 ac of non-tidal perennial aquatic (open water) habitat and up to approximately 1,100 ac of non-tidal freshwater perennial emergent wetland habitat into 473 ac of perennial aquatic (open water) habitat and a total of 1,056 ac of tidal (intertidal and shallow subtidal) freshwater emergent wetland types (see Impact 3.4-5). Overall, this would be an increase of approximately 123 ac of open water (aquatic) habitat and a decrease of approximately 44 ac of wetland habitats, and would be a less than significant impact. Similar to the Proposed Project (see Impact 3.4-6), Alternative 2 would result in the conversion of approximately 93 acres of existing valley/foothill riparian habitat below MHHW (6.5 ft [NAVD88]) to tidal freshwater emergent wetland habitat. However, potential areas suitable for riparian planting such as the dredged materials placement area in the south property, as well as along the Miner Slough levee road, would not be available under Alternative 2 such that the total long-term loss of valley/foothill riparian habitat would be approximately 41 ac, or a 14 ac greater loss than the Proposed Project. As with the Proposed Project, potential long-term impacts to individual high value trees for nesting and roosting would be minimized through implementation of Mitigation Measure 3.4-3.1. Long-term reduction in available habitat for special-status plant species adapted to current conditions would be the same under Alternative 2 as that of the Proposed Project (see Impact 3.4-7) and would be less than significant.

There is one elderberry shrub at the location of the proposed overflow weir for Alternative 2, and it would be removed as part of site preparation activities. In the short-term, removal of this shrub may impact valley elderberry longhorn beetle habitat as compared with the Proposed Project.

Impact 3.4-8: Short-term construction-related impacts to valley elderberry longhorn beetle

Elderberry shrubs provide potential habitat for the valley elderberry longhorn beetle. Alternative 2 would result in the removal of one elderberry shrub located along the Miner Slough levee in order to accommodate the proposed weir. However, because results from a focused botanical survey conducted in the summer of 2014 (Appendix E) indicated no evidence of beetle use of the shrubs at the Project site, the site’s distance from known populations of the beetle, and the adult beetle’s limited ability for distribution, the removal of a single elderberry shrub at the weir location under Alternative 2 would be a less-than significant impact.

Impact significance

Less than significant

In the long term, similar to the Proposed Project, there would be no impact on habitat for valley elderberry longhorn beetle under Alternative 2 (see Impact 3.4-9).

Under Alternative 2, short-term construction-related impacts to giant garter snakes, western pond turtles, special-status and migratory birds, and western red bats (see impacts 3.4-10, 3.4-12, 3.4-14, 3.4-16, and 3.4-17) would be the same as those under the Proposed Project. Implementation of mitigation measures 3.4-10.1, 3.4-12.1, 3.4-14.1 and 3.4-17.1 would reduce these impacts to less than significant.

As with the Proposed Project, Alternative 2 would increase aquatic habitat for the western pond turtle in the long-term, from the creation of tidal channels with adjacent basking habitat on exposed during the lower end of the tide cycle (see Impact 3.4-13). This would be beneficial. Compared with the Proposed Project, Alternative 2 would create approximately 4 additional acres (1,056 ac total) of intertidal and shallow subtidal freshwater emergent wetland habitat for foraging birds and also would also be beneficial (see Impact 3.4-16).

Compared to the Proposed Project, it is expected that Alternative 2 would provide approximately 4 additional acres (1,097 ac total) of giant garter snake foraging habitat in the long term (see also Impact 3.4-11). Although this is similar to the Proposed Project, Alternative 2 would result in a decrease of 18 ac of upland basking and over-wintering habitat and an increase of 156 ac of giant garter snake foraging habitat compared with existing conditions. As with the Proposed Project, conversion of marginal non-tidal perennial aquatic habitat and non-tidal freshwater perennial emergent wetland to tidal perennial aquatic and tidal freshwater emergent wetland habitats under Alternative 2 would be offset by the creation of a mosaic of habitats, including linear features that are consistent with the giant garter snake conservation strategy in the Bay Delta Conservation Plan, and would increase the acreage and value of available aquatic foraging habitats for giant garter snake. This would be a beneficial effect.

Alternative 2 would result in the permanent loss of 44 ac of freshwater emergent wetland (1,056 ac of intertidal + shallow subtidal wetland habitat partially offsetting the loss of 1,100 ac non-tidal wetland habitat), which provides foraging habitat for nesting raptors and nesting and foraging migratory birds. This would also result in an overall reduction of marginal foraging habitat for Swainson’s Hawks. Other emergent wetland habitat exists nearby the Project site for nesting; however, many of these species are territorial and reduction in available habitat may result in the displacement of nesting special-status birds in the vicinity of the Project site. As with the Proposed Project (see Impact 3.4-15), implementation of Mitigation Measure 3.4-3.1 would reduce these impacts to less than significant.

Geology and soils

Under Alternative 2, potential impacts to soils and geology would be the same as the Proposed Project.

Hazards and hazardous materials

Under Alternative 2, potential impacts (and benefits) from hazards and hazardous materials would be the same as for the Proposed Project.

Air quality

This alternative would involve construction of two levee breaches instead of three. As a result, the duration of construction period and the volumes of cut and fill would be slightly less under this alternative but the types and nature of construction activities would be similar to the Proposed Project. The slight decrease in construction activity is not large enough to change the significance of the air quality impacts; therefore, the air quality impacts of this alternative would be the same as those of the Proposed Project. Mitigation Measures 3.7-1.1 and 3.7-1.2 also would apply to this alternative.

Greenhouse gases

Dredging of the Miner Slough spur channel would not occur under Alternative 2, and thus any associated construction emissions would not occur. Additionally, the total volume of material to be excavated and re-used onsite would be lower under Alternative 2. Construction activities associated with overflow weir construction would be similar to the Proposed Project, and not large enough to offset the overall decrease in GHG emissions due to omission of spur channel dredging. Therefore, construction-related GHG emissions for this alternative would be less than the Proposed Project.

Mineral resources

Under Alternative 2, no impacts to mineral rights would occur because there would be no changes to access to the gas fields underlying portions of the Project site due to activities occurring on Prospect Island, and there are no other locally known mineral resources.

Noise

Construction under Alternative 2 would require the interior restoration efforts as described for the Proposed Project, plus construction of an overflow weir near Arrowhead Harbor Marina. This overflow weir would be located approximately 100 ft from the live-aboard residences and would entail dismantling the current levee buffering the residences from construction related noise impacts. Noise levels anticipated for the Arrowhead Harbor Marina residences would be the same as those described for the privately owned parcel connected to the central portion of the north property under the Proposed Project alternative (Impact 3.11-1). Additionally, the privately owned parcel would have noise impacts as described under the Proposed Project alternative. As with the Proposed Project, construction-related noise impacts would be potentially significant and would be reduced to less than significant with implementation of Mitigation Measure 3.10-1.1. Alternative 2 also would have no impact on sensitive receptors due to excessive construction-related ground-borne vibrations.

In the long-term, Alternative 2 would continue to require the same infrequent operations, maintenance, and monitoring activities within Prospect Island after construction as the Proposed Project (Impact 3.9-1). This would be less than significant impact on long-term ambient noise levels in the vicinity.

Aesthetics

This alternative would have visual impacts similar to those of the Proposed Project, except that the northern breach would be relocated and replaced with a weir. Although the weir would have a different appearance than the breach, the overall impacts would be similar.

Agricultural resources

As with the Proposed Project, Alternative 2 would have no impacts on agricultural lands because no such lands are present on the site. As with the Proposed Project, Alternative 2 would not result in substantial seepage to nearby farmland on adjacent islands, and there would be a less than significant impact on agricultural uses on those lands.

Cultural resources

Under Alternative 2, there would be no impacts to historical resources since the remaining buildings and levees to be demolished at the Project site do not qualify as historical resources. There would be no impacts to unknown archaeological resources and unknown human burials would be the same as for the Proposed Project. Implementation of Mitigation Measures 3.13-2.1, 3.13-3.1 and 3.13-4.1 would reduce these impacts to less than significant. As with the Proposed Project, there would be no impacts to paleontological resources.

Land use and planning/Population and housing

Under Alternative 2, land use impacts would be the same as those of the Proposed Project.

Public services

As with the Proposed Project, Alternative 2 would not result in new housing or commercial uses and thus would not generate additional demand for police or fire protection. The weir along the northern Miner Slough levee would be designed to permit passage by vehicles except during periods when the weir is inundated. On an annual basis, the frequency of weir overtopping was analyzed using long-term flood frequency data for the Sacramento River at Freeport in comparison with stage measurements from Miner Slough at the Highway 84 Bridge (cbec and WWR 2012). The data were then re-analyzed by season to capture a range of tidal and flood flow conditons in two representative water year types using a design weir crest elevation of 7 feet NAVD88 (Table 4-2).

Table 4.5-1. Analysis of Inundation Frequency and Duration for the Overflow Weir Under Alternative 2 Based on Stage Data from Miner Slough at Hwy 84 Bridge (USGS 11455165)

Year	Type	No. of Events	Inundation Event Depth			Inundation Event Duration		
			Avg (ft)	Min (ft)	Max (ft)	Avg (hr)	Min (hr)	Max (hr)
Events exceeding 7 ft NAVD88 during January-June in representative WY Types								
2007	Dry	6	0.10	0.01	0.23	1.29	0.25	2.75
2008	Dry	15	0.29	0.01	1.18	2.57	0.50	7.75
2010	Wet*	27	0.56	0.01	2.16	9.07	0.50	114
2011	Wet*	80	1.90	0.01	4.52	12.72	0.00	642
Events exceeding 7 ft NAVD88 during July-December in representative WY Types								
2007	Dry	6	0.14	0.01	0.38	1.13	0.25	2.25
2008	Dry	7	0.15	0.01	0.38	1.39	0.25	2.50
2010	Wet*	12	1.51	0.01	3.42	27.1	0.50	286
2011	Wet*	10	0.22	0.01	0.63	2.00	0.25	4.50

* Year included Yolo Bypass flood events

Overall, tidal inundation of the weir would occur approximately once per month for a period of 1 hour at depths of less than 6 inches (see July - December results for 2007–2008). At higher river stages during winter (January–June), inundation would occur more frequently, with 27–80 inundation events estimated to occur based on WY 2010 - 11 data. These high flow inundation events would prohibit vehicle passage for 13 hours on average, with the maximum duration estimated at 642 hrs (27 days) based on January 2011 data. Although Alternative 2 would reduce police and fire vehicle access impacts relative to the Proposed Project by allowing access via the road across the Miner Slough levee weir, the loss of police and fire vehicle access during flood conditions would be a significant impact. Implementation of Mitigation Measure 3.17-2.1 would reduce this impact to less than significant.

Recreation

As with the Proposed Project, Alternative 2 would create short-term construction-related impacts to recreational boating due to limited or prohibited use of the Arrowhead Harbor Marina and Miner Slough. Implementation of Mitigation Measure 3.16-1.1 would reduce these impacts to less than significant.

Hydraulic changes induced close to the entrance to Arrowhead Harbor Marina would potentially impact recreational boating during flood flow conditions. The marina entrance, located just north of Prospect Island along Miner Slough, is immediately adjacent to the proposed location of the overflow weir to be built at an elevation of 7 ft. Thus, when water stage within Miner Slough exceeds 7 ft, changes to flow velocity and direction at the entrance to the marina would begin to occur. The magnitude of these changes would increase as stage and flow increase. Modeling results quantify these changes to both water velocity and flow direction near the entrance of Arrowhead Harbor Marina; flow direction would shift from a north-south orientation (in line with the harbor entrance) to a more east-west direction (orthogonal to the harbor entrance), and water velocity tangential to the marina's entrance would increases from about 1 fps to about 2.5 fps (WWR and SWS 2013b). However, because velocities in excess of these levels occur within the main channel of Miner Slough during flood conditions, potential navigation risks related to current orientation at the mouth of the marina are comparable to those occurring along nearby meander bends. Further, little or no boat traffic is typically present during such conditions (J. Fonss, Arrowhead Harbor Marina, pers. comm., May 2014). Therefore, this would be a less than significant impact.

Long-term changes to water velocity in other areas of Miner Slough during high flow periods under Alternative 2 would be similar to or only slightly higher than described for the Proposed Project (Impact 3.16-2). As with the Proposed Project, little or no boat traffic is typically present during such conditions. Furthermore, high flow conditions and velocities would be within the range of such conditions in other nearby Delta channels, and thus navigation in other areas of Miner Slough under such conditions would not present challenges to boat operators that would not otherwise be typically encountered elsewhere in the Delta. Therefore, with the exception of the Arrowhead Harbor Marina entrance, there would be a less than significant impact on long-term changes to water velocity in Miner Slough under Alternative 2.

Impact significance
Less than significant

Transportation and traffic

Compared to the Proposed Project, short-term construction-related impacts would be similar to the Proposed Project because access could be temporarily impeded. Mitigation Measure 3.17-1.1 would reduce this impact to less than significant.

Alternative 2 would reduce long-term vehicle access impacts relative to the Proposed Project because it would allow access via a road across the proposed Miner Slough levee weir, except for 27–80 inundation events lasting approximately 13 hrs or more, depending on tide conditions and flood flows (See Table 4-2). The temporary loss of vehicle access to the northern portion of the Miner Slough levee during flood conditions would be a significant impact. Implementation of Mitigation Measure 3.17-2.1 would reduce this impact to less than significant.

Utilities

Under Alternative 2, the solid waste disposal impacts (Impact 3.18-1) would be similar to the Proposed Project because the same amount of resultant spoil materials (65,000 cubic yards) would be re-used onsite. As with the Proposed Project, one or more local landfills could accommodate the disposal needs of Alternative 2 (e.g., debris, wooden electrical distribution poles, lead paint from old buildings, excavated soil contaminated with drilling fluids additives). Potential effects to easement holders (Impact 3.18-3) also would be the same as under the

Proposed Project. Overall, solid waste disposal and potential effects to easement holders would be less than significant.

The potential for adverse effects on existing utilities (Impact 3.18-2) would be similar to the Proposed Project because the PG&E distribution lines and poles within Prospect Island would be removed and it is possible that some unknown or unmarked subsurface utilities may exist on the site (i.e., old pipelines or septic tanks) that could be encountered during project grading. Mitigation Measure 3.18-2.1 would reduce this impact to less than significant.

4.6 Alternative 3: Three Breaches

4.6.1 Description

Under Alternative 3, three breaches would be created on the Miner Slough levee: two in the north property, the first approximately 0.5 miles south of Arrowhead Harbor Marina, the second in the central portion of the Miner Slough levee just north of the 9-ac privately owned property. On the south property, the third breach would be constructed at the location of the formerly repaired breach connecting the Miner Slough spur channel to the south property (Figure 4.6-1). Under this alternative, the internal cross levee separating the north and the south properties would remain intact, and the levee road and portions of the Miner Slough levee south of the central breach would be maintained. DWR would protect the cross levee from potential impacts by raising, reinforcing, and/or widening the half-mile cross levee on Prospect Island. Because the north and south properties would not be hydraulically connected, except via tidal exhanges with Miner Slough, no dredging of the Miner Slough spur channel would be required under Alternative 3. Once the Miner Slough levee is breached, the north and south properties would be subject to daily tidal inundation.

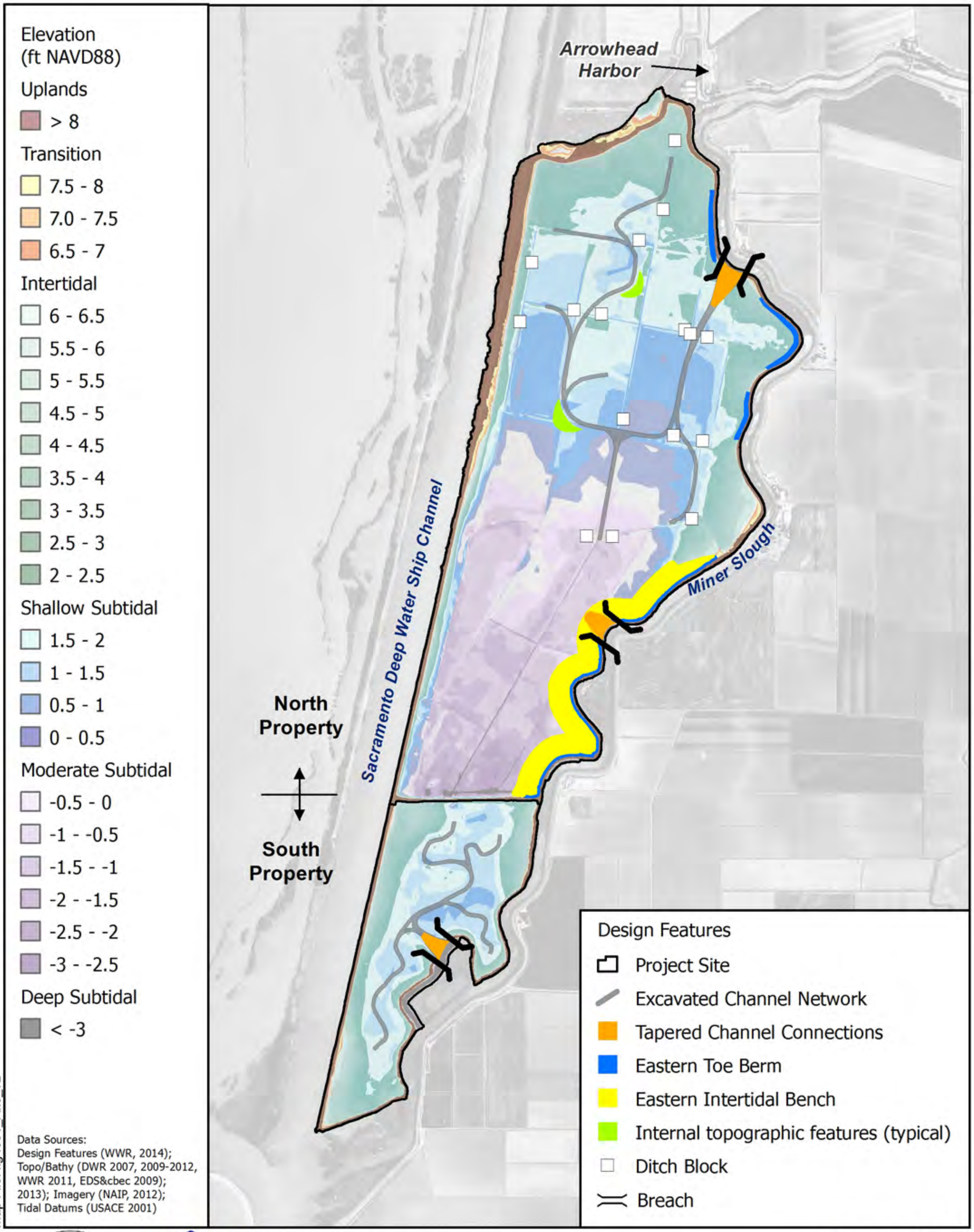

Figure 4.6-1

Restoration Alternative 3

PROSPECT ISLAND TIDAL HABITAT RESTORATION PROJECT

4.6.2 Environmental impacts

Hydrology

Phase 1 and Phase 2 hydrodynamic modeling completed during the Prospect Island habitat restoration conceptual planning phase included a variety of configurations with varying numbers and locations of breaches along both Miner Slough and the DWSC (SWS and WWR 2012, WWR and SWS 2014). All of the modeled alternatives included hydraulic connection between the north and south properties. The overall change in the tidal prism would be similar to that of the Proposed Project. Thus, hydrologic impacts related to agricultural water supply and drainage and the potential for erosion of the Miner Slough levee would be the same as those described for the Proposed Project. Like the Proposed Project, because the channel bottom of Miner Slough is already physically and hydrologically connected to sand lenses underlying Ryer Island, peak velocities in Miner Slough under Alternative 3 are unlikely to alter existing seepage rates within Ryer Island. Therefore, as with the Proposed Project, Alternative 3 is not expected to have any substantial seepage effects on Ryer Island. Similarly, there would be no construction related impacts to groundwater supplies and third party wells under Alternative 3.

As with the Proposed Project, there would be no impact on flood conveyance or regional D-1641 flow requirements. This alternative also would have no impact on scour that could impact stability of nearby bridges, trestles, culverts or other structures, and it would not affect water rights due to surface water diversion.

Water quality

Under Alternative 3, short-term construction-related impacts to water quality would be less than those of the Proposed Project. There would be no dredging under Alternative 3, which would eliminate short-term construction-related increases in turbidity and suspended sediment levels within Miner Slough and in downstream waters due to mechanical dredging of the spur channel. However, there would be three levee breaches to Miner Slough totaling approximately 1,800 ft in length and 85,000 cubic yards in volume (above and below MHHW) in order to reconnect the north and south properties to tidal action. Levee breaches would occur at the end of the restoration project from August to mid-November 2018. On balance, Alternative 3 would result in decreased potential for turbidity and suspended sediment impacts as compared to the Proposed Project.

As with the Proposed Project, implementation of Mitigation Measures 3.2-1.1, 3.2-1.2, 3.2-1.3, 3.2-2.1, 3.2-3.1 and 3.2-3.2 would reduce the remaining short-term construction-related impacts of increased turbidity, pollutants, and herbicide use on water quality in the vicinity of Prospect Island to less than significant.

Long-term effects on salinity and water temperature (Impacts 3.2-5, 3.2-6) under Alternative 3 would be the same as the Proposed Project. These impacts would be less than significant for salinity and beneficial for water temperature. The increased number of breaches along Miner Slough would potentially result in greater export of DOC to adjacent waterways as compared to the Proposed Project (Impact 3.2-7). However, similar to the Proposed Project, DOC export would not result in substantial adverse effects on beneficial uses of water, in particular municipal drinking water supply at the Barker Slough Pumping Plant and would be a less than significant effect on long-term DOC concentrations in the Delta.

As with the Proposed Project, Alternative 3 would convert existing perennially flooded freshwater emergent marsh to tidal freshwater emergent marsh, which may affect the rate of methylmercury production and degree of bioaccumulation in higher trophic level organisms resident at the Project site and may result in subsequent transport of methylmercury to downstream waterbodies. If methylmercury production increases, and depending on the magnitude of the increase, this could result in adverse, few, or no effects on public health or environmental receptors due to elevated methylmercury concentrations in the tissue of fish, birds, mammals, and humans that consume contaminated organisms.

Factors controlling the production and bioaccumulation of methylmercury and its ability to be transported from tidal wetlands into downstream waterbodies are complex and not yet fully understood (see Impact 3.2-8). Based upon the CALFED Science Program Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) conceptual model of methylmercury production, habitat flooding frequency corresponds with a methylmercury gradient, from relatively low methylmercury concentrations in the overlying water column of perennially flooded habitats (e.g., open water areas), low to moderate concentrations in habitats that flood frequently and do not fully dry between inundation events (e.g., low elevation tidal marsh), and potentially higher concentrations in areas that flood less frequently and dry out between inundation events (e.g., seasonal floodplains or wetlands and high elevation tidal marsh) (Alpers et al. 2008).

As with the Proposed Project, restoration of tidal action to the site under Alternative 3 would result in the conversion of existing perennially flooded emergent marsh (i.e., associated with low to moderate methylmercury concentrations) to open water habitat (i.e., associated with low methylmercury concentrations). It is anticipated that the small increase in the area of infrequently flooded habitat between MHW and MHHW on the land-side of the perimeter levees would potentially result in increased methylmercury production. However, the increase in methylmercury production would be partially offset by the increases in open water habitat associated with lower production and bioaccumulation potential. Under Alternative 3, there is potential for greater export of methylmercury as compared with the Proposed Project due to the additional breach along the Miner Slough levee. Despite this, given scientific uncertainty regarding the degree to which freshwater tidal wetlands contribute to Delta methylmercury loading now and in the future (see also Impact 3.2-8), ongoing DWR and CDFW mercury compliance control studies (see also Impact 3.2-8), and the small degree of anticipated production under Alternative 3, this would be a less than significant impact.

As with the Proposed Project, Alternative 3 would have no impact on groundwater quality.

Aquatic biological resources

Under Alternative 3, dredging of the Miner Slough spur channel would not be necessary with similar potential for short-term impacts related to the temporary repair of the south property levee (Impact 3.3-1). Impact 3.3-5 would not occur. Short-term impacts to fish species related to direct injury, impediment to migration, and impairment of essential fish behaviors (Impacts 3.3-3, 3.3-4, 3.3-6) would be potentially greater than those of the Proposed Project since there would be three levee breaches to Miner Slough. However, since there would be no dredging under Alternative 3, the degree of short-term impacts related to direct injury, impediment to migration, and impairment of essential fish behaviors (Impacts 3.3-3, 3.3-4, 3.3-6) would be reduced, as compared with the Proposed Project. Implementation of the associated mitigation measures (3.3-3.1, 3.3-3.2, 3.2-2.1) would reduce these impacts to less than significant. Further, the mitigation associated with Impact 3.3-6 would still be necessary. Lastly, potential fish injury or mortality impacts due site dewatering and herbicide application (Impacts 3.3-7 and 3.3-8) would be the same as the Proposed Project and implementation of the associated mitigation measures (3.3-7.1, 3.2-3.1, and 3.2-3.2) would reduce these impacts to less than significant.

Under Alternative 2, dredging of the Miner Slough spur channel would not be necessary with similar potential for short-term impacts related to the temporary repair of the south property levee (Impact 3.3-1). Impact 3.3-5 would not occur and impacts 3.3-3, 3.3-4, and 3.3-6 would be reduced. The mitigation associated with Impact 3.3-6 would still be necessary. Lastly, potential fish injury or mortality impacts due site dewatering and herbicide application (Impacts 3.3-7 and 3.3-8) would be the same as the Proposed Project and implementation of the associated mitigation measures (3.3-7.1, 3.2-3.1, and 3.2-3.2) would reduce these impacts to less than significant.

As with the Proposed Project, Alternative 3 would be beneficial with respect to long-term conversion and enhancement of aquatic habitat (Impact 3.3-2), and water temperatures (Impact 3.3-10). The addition of a third breach along Miner Slough would increase potential for food export to other habitats within the Cache Slough Complex relative to the Proposed Project (WWR-Stillwater Sciences 2014).

Under Alternative 3, the potential for establishment of Asian clam at the Project site (Impact 3.3-11) and potential food web impacts due to increased levels of methylmercury bioaccumulation (Impact 3.3-12) would be the same as that of the Proposed Project and would be less than significant.

Wetland and terrestrial biological resources

Short-term, construction-related impacts to wetland and terrestrial resources under Alternative 3 would be similar to those of the Proposed Project. Implementation of Mitigation Measures 3.4-4.1 through 3.4-17.1 would reduce these impacts to less than significant.

With respect to potential long-term effects, the addition of a third breach location along the Miner Slough levee would result in a slight reduction of tidal freshwater emergent wetland in the vicinity of the central breach location compared with the Proposed Project. This loss would be partially offset by increased amounts of shallow subtidal habitat in the vicinity of the internal cross levee breach, where the latter is not part of Alternative 3. Compared with existing conditions, there would still be a long-term increase in freshwater emergent wetland at the site as a whole. This would be a beneficial effect.

With respect to long-term effects on valley/foothill riparian habitat, the addition of the third breach as well as the required ongoing levee maintenance access for the privately owned parcel connected to the central portion of the north property along Miner Slough, would result in a greater loss of this habitat type compared to the Proposed Project. This impact would be avoided if the privately owned property is acquired in its entirety. This would represent an additional loss of up to 5 ac of valley/foothill riparian habitat compared to the Proposed Project. However, with implementation of design features (e.g., planting) as well as mitigation measures detailed under the Proposed Project, potential impacts to riparian resources and riparian-associated species (e.g., plants, Swainson's Hawk, western red bat) would be reduced to less than significant.

Geology and soils

Under Alternative 3, beneficial effects on Miner Slough levee stability would be similar to those of the Proposed Project. Alternative 3 would also include raising, reinforcing, and/or widening the half-mile cross levee on Prospect Island separating the north and south properties. Thus, improved stability of the cross levee would be a beneficial effect under Alternative 3.

As with the Proposed Project, Alternative 3 would support inorganic sediment accretion, help reverse existing land subsidence, offset future subsidence, and support system resiliency to mean sea level rise (see also Section 3.19.3 Summary of cumulative impacts – Geology and soils).

Hazards and hazardous materials

Under Alternative 3, potential impacts (and benefits) from hazards and hazardous materials would be the same as for the Proposed Project.

Air quality

The volumes of the imported and exported construction materials, the volumes of soil cut and fill, as well as other work load anticipated to complete this alternative, including the additional Miner Slough levee breach and improvements to the half-mile cross levee between the north and south properties, would be greater than the Proposed Project. The nature and timing of the construction of activities would be similar to the Proposed Project, and the larger work load for this project would generate greater air pollutant emissions; as a result, air quality impacts associated with this alternative would be greater than those of the Proposed Project, which are already over twice that of the YSAQMD threshold value for maximum annual NO_x emissions. As with the Proposed Project, implementation of Mitigation Measure 3.7-1.1 would reduce NO_x emissions, however, reductions would not be sufficient to result in a less than significant level of impact.

Therefore, air quality impacts associated with NO_x under Alternative 3 would be significant and unavoidable.

Greenhouse gases

With the additional Miner Slough levee breach and improvements to the half-mile cross levee between the north and south properties under Alternative 3, the total volume of material to be excavated and re-used onsite would be greater compared to the Proposed Project. Therefore, construction related GHG emissions for this alternative would be greater than the Proposed Project. However, as with the Proposed Project, the incremental contribution to the cumulative impact of increasing atmospheric levels of GHGs would be less than cumulatively considerable and, therefore, less than significant.

Mineral resources

Under Alternative 3, no impacts to mineral rights would occur because there would be no changes to access to the gas fields underlying portions of the Project site due to activities occurring on Prospect Island, and there are no other locally known mineral resources.

Noise

Impacts of Alternative 3 would be greater than the Proposed Project due to increased construction activities. Implementation of Mitigation Measure 3.10-1.1 would reduce these impacts to less than significant.

In the long-term, Alternative 3 would continue to require similar infrequent operations, maintenance, and monitoring activities as the Proposed Project within the north property only (Impact 3.9-1). This would be less than significant impact on long-term ambient noise levels in the vicinity.

Aesthetics

Under Alternative 3, an additional breach would be located in the central portion of the Miner Slough levee just north of the 9-ac privately owned property. However, overall visual impacts of this alternative would be similar to those of the Proposed Project.

Agricultural resources

As with the Proposed Project, Alternative 3 would have a less than significant impact on agricultural lands because the long-term conversion of 17.7 ac of agricultural land north of the northern cross levee to valley/foothill riparian habitat represents a very small portion of total local agricultural lands (<0.5%). In addition, Alternative 3 would not result in substantial seepage to nearby farmland on adjacent islands, and there would be a less than significant impact on agricultural uses on those lands.

Cultural resources

Under Alternative 3, there would be no impacts to historical resources since the remaining buildings and levees to be demolished at the Project site do not qualify as historical resources. Under Alternative 3, the impacts to unknown archaeological resources and unknown human burials would be the same as for the Proposed Project. Implementation of Mitigation Measures 3.13-2.1, 3.13-3.1 and 3.14-4.1 would reduce these impacts to less than significant. As with the Proposed Project, there would be no impacts to paleontological resources.

Land use and planning/Population and housing

Under Alternative 3, land use impacts would be the same as those of the Proposed Project.

Public services

Alternative 3 would create three breaches on Miner Slough in the northern, central, and southern parts of the island while leaving the cross levee intact, which would maintain access to the privately owned property via the DWSC and interior cross levee. It is also possible under this alternative that access rights attendant to the privately owned property could be acquired, or the property could be acquired in its entirety. A section of the Miner Slough levee would still be rendered inaccessible after the breaches are constructed, however emergency access could still be via the DWSC and interior cross levee, or by boat, therefore this impact would be considered less than significant.

Recreation

Under Alternative 3, short-term construction-related impacts would be the same as under the Proposed Project and would be reduced to less than significant with implementation of Mitigation Measure 3.16-1.1. All other impacts would be the same as under the Proposed Project.

Transportation and traffic

Alternative 3 would maintain the interior cross levee, and breaches on the north property would be north of the privately owned parcel. Therefore, under this alternative, access to the privately owned parcel would still be available via the DWSC, the cross levee, and then up the Miner Slough levee. It is also possible under this alternative that access rights attendant to the privately owned parcel could be acquired, or the parcel could be acquired in its entirety. A section of the Miner Slough levee would still be rendered inaccessible after the breaches are constructed, however maintenance could still be conducted via the DWSC and interior cross levee, or by boat, therefore this impact would be considered less than significant.

This alternative would entail slightly more construction than the Proposed Project, including an additional breach in the Miner Slough levee as well as improvements to the half-mile cross levee between the north and south properties. Therefore, traffic impacts during construction would be slightly greater than those of the Proposed Project. However, implementation of Mitigation Measure 3.17-1.1 would reduce this impact to less than significant.

Utilities

Under Alternative 3, solid waste disposal and potential effects to easement holders would be the same as the Proposed Project and would be less than significant.

The potential for adverse effects on existing utilities (Impact 3.18-2) would be similar to the Proposed Project because the PG&E distribution lines and poles within Prospect Island would be removed and it is possible that some unknown or unmarked subsurface utilities may exist on the site (i.e., old pipelines or septic tanks) that could be encountered during project grading. Mitigation Measure 3.18-2.1 would reduce this impact to less than significant.

4.7 Comparison of Alternatives and Identification of Environmentally Superior Alternative

The CEQA Guidelines (Sections 15126.6(d), 15126.6(e)) require that the EIR designate an environmentally superior alternative to the Proposed Project. If the alternative with the least environmental impact is the No Project Alternative, then one of the other remaining alternatives is to be designated as the environmentally superior alternative.

Table 4.7-1 presents a summary of effects of the Proposed Project to those of the alternatives using the analyses conducted by resource area. Each alternative is ranked in comparison to the Proposed Project as environmentally superior (“+” fewer impacts), potentially superior (“=/+”), the same as (“=”), potentially inferior (“=/-”), or inferior (“-“, more impacts or fewer benefits). On balance, this comparison shows that Alternative 1, the No Project Alternative, would have the least environmental impact. However, this is not unexpected because the majority of short-term construction-related impacts under the Proposed Project would not occur under the No Project Alternative. Further, maintaining existing conditions at Prospect Island under this alternative would not meet any of the Project objectives including enhancement of primary productivity and food availability for fisheries in the Delta; increasing the quantity and quality of salmonid rearing habitat and habitat for other listed species; enhancement of water quality, recreation and carbon sequestration in tidal marshes; promotion of habitat resiliency; and promote habitat conditions that support native species.

As noted above, CEQA requires that the EIR identify an environmentally superior alternative other than the No Project Alternative. Alternatives 2 and 3 are both environmentally superior compared with the Proposed Project because neither would require dredging of the Miner Slough spur channel, resulting in reduced short-term construction-related impacts to water quality and aquatic species in Miner Slough. However, Alternative 2 is slightly more beneficial than Alternative 3 due to the replacement of the northern Miner Slough breach, which requires full excavation of the levee during construction, with a weir, which requires only partial excavation. The weir would result in slightly lower export of primary productivity to surrounding Delta waterways as compared to a breach in this location under the Proposed Project and Alternative 3; this would be a reduced benefit. However, the weir would also result in lower potential export of water quality consitituents of concern (e.g., DOC, methylmercury), to adjacent waterways (Section 4.6.2) relative to the Proposed Project and Alternative 3. Although Alternative 2 would result in the greatest potential impact to valley/foothill riparian habitat, increased amounts of freshwater tidal emergent marsh would be relatively more beneficial to wetland-associated species (e.g., giant garter snakes, western pond turtles, special-status and migratory birds, and western red bats) than the other alternatives. Lastly, under Alternative 2, access to the privately owned parcel connected to the central portion of the north property along Miner Slough would be available via the road across the Miner Slough levee weir, except during flood conditions (Section 4.6.2).

Table 4.7-1. Comparison of Proposed Project Effects to Those Under the Alternatives.
B = beneficial, LTS = less than significant, LTSM = less than significant with mitigation, NI = no impact, SU = significant and unavoidable. Each alternative is ranked in comparison to the Proposed Project as environmentally superior ("+" fewer impacts), potentially superior ("=/+"), the same as ("="), potentially inferior ("=/-"), or inferior ("-", more impacts or fewer benefits).

Impact No.	Impact Title	PP	Comparison to Proposed Project		
			Alt 1	Alt 2	Alt 3
	HYDROLOGY				
3.1-1	Potential changes in agricultural water supply and drainage due to changes in tidal range	LTS	=/+	=	=
3.1-2	Potential impacts to Sacramento River Flood Control Project and Yolo Bypass Floodway flood conveyance	NI	=	=	=
3.1-3	Groundwater seepage impacts from Prospect Island to adjacent areas	LTS	=/+	=	=
3.1-4	Potential wind-wave erosion of the interior side of Prospect Island levees	LTS	=/+	=	=
3.1-5	Potential toe-scour and erosion of Miner Slough levees affecting Ryer Island levee stability	LTS	=/+	=/-	=
3.1-6	Potential increase in seepage on adjacent lands due to Miner Slough bed scour	LTS	=/+	=	=
3.1-7	Potential impacts to regional flow resulting in non-compliance with D-1641 flow requirements on the Sacramento River at Rio Vista	NI	=	=	=
3.1-8	Potential scour impacting stability of nearby bridges, trestles, culverts or other structures	NI	=	=	=
3.1-9	Potential impacts to water rights from diversion of surface water	NI	=	=	=
3.1-10	Potential construction related impacts to groundwater supplies and third party wells	NI	=	=	=
	WATER QUALITY				
3.2-1	Short-term construction-related water quality impacts	LTSM	+	=	=
3.2-2	Short-term construction-related increases in turbidity from dredging and excavation of levee breaches	LTSM	+	+	=/+
3.2-3	Short-term construction-related effects from application of aquatic herbicides	LTSM	+	=	=
3.2-4	Short-term construction-related effects on water temperature in adjacent waterbodies due to dewatering activities	NI	+	=	=
3.2-5	Long-term effects on salinity in waterbodies near Prospect Island	LTS	+	=	=
3.2-6	Long-term effects on water temperature within Prospect Island and in nearby waterbodies	B	-	=	=
3.2-7	Long-term effects on primary productivity and dissolved organic carbon (DOC) within and near Prospect Island	LTS	+	=/+	=/-

Impact No.	Impact Title	PP	Comparison to Proposed Project		
			Alt 1	Alt 2	Alt 3
3.2-8	Long-term effects on methylmercury production, bioaccumulation, and export	LTS	=/+	=/+	=/-
3.2-9	Potential effects on groundwater quality	NI	=	=	=
AQUATIC BIOLOGICAL RESOURCES					
3.3-1	Short-term loss and degradation of aquatic habitat from construction-related activities	LTS	+	=/+	=/+
3.3-2	Long-term conversion and enhancement of aquatic habitat	B	-	=/-	=/+
3.3-3	Short-term direct construction-related injury or mortality of fish	LTSM	+	=/+	=/+
3.3-4	Short-term construction-related noise impediments to fish migration	LTSM	+	=/+	=/+
3.3-5	Short-term impairment of essential fish behaviors due to potential increases in turbidity during underwater sediment sampling activities	LTS	+	+	+
3.3-6	Short-term impairment of essential fish behaviors due to construction-related increases in turbidity	LTSM	+	=/+	=/+
3.3-7	Short-term fish injury or mortality due to dewatering	LTSM	+	=	=
3.3-8	Fish Injury or mortality due to herbicide application	NI	+	=	=
3.3-9	Post-construction increased predation on native fish	LTS	n/a	=	=
3.3-10	Long-term impacts to fish in Prospect Island and adjacent water bodies from changes in water temperature	B	-	=	=
3.3-11	Altered habitat and food web from invasion by asian clam	LTS	+	=	=
3.3-12	Food web impacts from increased levels of methylmercury bioaccumulation	LTS	+	=/+	=/-
WETLAND AND TERRESTRIAL BIOLOGICAL RESOURCES					
3.4-1	Short-term impacts to perennial aquatic habitats and wetland communities from site dewatering	SU	+	=	=
3.4-2	Short-term impacts to tidal aquatic habitats and wetland communities from dredging in the Miner Slough spur channel	NI	=	=	=
3.4-3	Short-term loss of valley/foothill riparian habitat	LTSM	+	=	=
3.4-4	Short-term construction-related mortality or detrimental effects to sensitive plants	LTSM	+	=	=
3.4-5	Long-term conversion of perennial aquatic habitats and wetland communities to tidal habitat types	LTS	=/-	=	=/-
3.4-6	Long-term loss of valley/foothill riparian habitat	LTSM	=/+	-	=/-
3.4-7	Reduction in available habitat for special-status plant species adapted to current conditions	LTS	+	=	=/-
3.4-8	Short-term construction-related impacts to valley elderberry longhorn beetle	NI	=	=/-	=

Impact No.	Impact Title	PP	Comparison to Proposed Project		
			Alt 1	Alt 2	Alt 3
3.4-9	Long-term impacts to valley elderberry longhorn beetle	NI	=	=	=
3.4-10	Short-term construction-related injury or mortality and loss of habitat for giant garter snakes	LTSM	+	=	=
3.4-11	Long-term conversion of giant garter snake habitat	LTS	=/-	=	=
3.4-12	Short-term construction-related habitat loss and injury or mortality of individual western pond turtles	LTSM	+	=	=
3.4-13	Long-term conversion of western pond turtle habitat	B	-	=	=/-
3.4-14	Short-term, construction-related injury or mortality, take of nests, and loss of nesting and foraging habitat of special-status and migratory birds	LTSM	+	=	=
3.4-15	Long-term conversion of nesting and foraging habitat for special-status and migratory birds	LTSM	=/+	=/+	=/-
3.4-16	Post-construction conversion to tidal habitat suitable for foraging migratory birds	B	=/-	=/+	=/-
3.4-17	Short-term, construction-related injury or mortality and loss of roosting and foraging habitat for western red bats	LTSM	+	=	=
3.4-18	Long-term removal of western red bat roosting and foraging habitat	LTSM	=/+	=	=/-
	GEOLOGY AND SOILS				
3.5-1	Long-term effect on exposure of people and structures to seismic- and landslide-related hazards	B	-	=	=
3.5-2	Long-term effect on sediment deposition and erosion in the vicinity of Prospect Island	B	-	=	=
	HAZARDS AND HAZARDOUS MATERIALS				
3.6-1	Potential effects from abandoned gas wells	LTSM	+	=	=
3.6-2	Potential effects from contaminant migration via existing groundwater monitoring wells	LTSM	+	=	=
3.6-3	Potential mobilization of contaminants from levee breaching and/or sediment dredging and re-use	LTSM	+	=	=/+
3.6-4	Hazards associated with the Prospect Island houses on the north property	B	-	=	=
3.6-5	Potential hazards associated with the abandoned house on the south property	B	-	=	=
3.6-6	Potential soil or water contamination from onsite equipment storage and fueling	LTSM	+	=	=
3.6-7	Potential effects on human health due to the short-term use of aquatic-approved herbicides prior to site construction	LTSM	+	=	=
3.6-8	Potential effects on human health due to changes in the extent of mosquito breeding habitat	B	-	=	=

Impact No.	Impact Title	PP	Comparison to Proposed Project		
			Alt 1	Alt 2	Alt 3
AIR QUALITY					
3.7-1	Generation of criteria pollutant emissions that contribute to air quality violations	SU	+	=	=/+
3.7-2	Conflict with or obstruct applicable general plans or regional air quality plans	SU	+	=	=/+
3.7-3	Expose sensitive receptors to air pollutants and cause higher health risks	LTS	=	=	=/+
3.7-4	Expose sensitive receptors to objectionable odors	LTS	+	=	=/+
GREENHOUSE GASSES					
3.8-1	Proposed Project-related GHG emissions	LTS	+	+	=/+
MINERAL RESOURCES					
3.9-1	Loss of a known mineral resource that would be of value to the region and residents of the state	NI	=	=	=
3.9-2	Loss of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	NI	=	=	=
NOISE					
3.10-1	Potential for short-term noise disturbance to nearby residents	LTSM	+	=	=/+
3.10-2	Potential for long-term increases in ambient noise levels in the Proposed Project vicinity	LTS	+	=	=
3.10-3	Potential for sensitive receptors to be exposed to excessive ground-borne vibrations during construction-related activities	NI	=	=	=/+
AESTHETICS					
3.11-1	Temporary change in views during construction	LTS	+	=	=
3.11-2	Long-term change in views from State Route 84	LTS	+	=	=
3.11-3	Long-term change in views from Arrowhead Harbor Marina	LTS	+	=	=
3.11-4	Long-term change in views from boats in Miner Slough	LTS	+	=	=
3.11-5	Long-term change in views from boats in the Deep Water Ship Channel	LTS	+	=	=
3.11-6	Long-term change in views from nearby residences	LTS	+	=	=
3.11-7	Long-term light and glare	NI	=	=	=

Impact No.	Impact Title	PP	Comparison to Proposed Project		
			Alt 1	Alt 2	Alt 3
AGRICULTURAL AND FORESTRY RESOURCES					
3.12-1	Loss or conversion of prime, unique, or important agricultural lands	LTS	=	=	=
3.12-2	Conflicts with Williamson Act contracted lands	NI	=	=	=
3.12-3	Potential effects to agricultural uses on adjacent lands	LTS	+	=	=
CULTURAL RESOURCES					
3.13-1	Impacts to historical resources on land	NI	=	=	=
3.13-2	Inadvertent discovery of a shipwreck during in-water construction	LTSM	+	=	=
3.13-3	Impacts to unknown archaeological resources	LTSM	+	=	=
3.13-4	Impacts to unknown human burials	LTSM	+	=	=
3.13-5	Impacts to paleontological resources	NI	=	=	=
LAND USE AND PLANNING/POPULATION AND HOUSING					
3.14-1	Potential conflicts with adjacent land uses	LTSM	+	=	=
3.14-2	Potential conflict with plans and policies	NI	=	=	=
3.14-3	Population and housing effects	NI	=	=	=
PUBLIC SERVICES					
3.15-1	Potential conflict with existing police and fire protection services	LTSM	+	-/+	+
RECREATION					
3.16-1	Short-term construction-related impacts to recreational boating in Miner Slough and Arrowhead Harbor Marina	LTSM	+	=	=
3.16-2	Long-term impacts to recreational boating in Miner Slough and Arrowhead Harbor Marina	LTS	+	=	=
3.16-3	Long-term Impacts on recreational use of Prospect Island	NI	=	=	=
3.16-4	Consistency with existing plans	LTS	+	=	=
TRANSPORTATION AND TRAFFIC					
3.17-1	Potential traffic impacts during construction	LTSM	+	=	=
3.17-2	Potential long-term loss of access to Miner Slough levee	LTSM	+	-/+	+

Impact No.	Impact Title	PP	Comparison to Proposed Project		
			Alt 1	Alt 2	Alt 3
	UTILITIES				
3.18-1	Solid waste disposal impacts	LTS	+	=	=
3.18-2	Potential for adverse effects on existing utilities	LTSM	+	=	=
3.18-3	Potential for adverse effects to easement holders	LTS	+	=	=

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6 REFERENCES

Adams, P. B., C. B. Grimes, S. T. Lindley, and M. L. Moser. 2002. Status review for North American green sturgeon, *Acipenser medirostris*. National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, California and NMFS, Northwest Science Center, Seattle, Washington.

Alpers, C., C. Eagles-Smith, C. Foe, S. Klasing, M. Marvin-DiPasquale, D. Slotton, and L. Winham-Myers. 2008. Mercury conceptual model. Sacramento-San Joaquin Delta Regional Ecosystem Restoration Implementation Plan. Sacramento, California.

Annand, E. M., and F. R. Thompson, III. 1997. Forest bird response to regeneration practices in central hardwood forests. The Journal of Wildlife Management 61:159-171.

Armor, C., R. Baxter, W. Bennett, R. Breuer, M. Chotkowski, P. Coulston, D. Denton, B. Herbold, W. Kimmerer, K. Larsen, M. Nobriga, K. Rose, T. Sommer, and M. Stacey. 2005. Interagency Ecological Program synthesis of 2005 work to evaluate the pelagic organism decline (POD) in the upper San Francisco Estuary. Stockton, California.

Arrowhead Harbor Marina. 2014. ”Arrowhead Harbor on Miner Slough.” Clarksburg (CA). Website. Viewed online at: http://arrowheadharbor.com/index.html

Atwater, B. F. 1982. Geologic maps of the Sacramento-San Joaquin Delta, California. U.S. Geological Survey Miscellaneous Field Studies Map MF-1401. Scale 1:24,000. http://pubs.er.usgs.gov/publication/mf1401

Azat, J. 2014.GrandTab 2014.04.22 California Central Valley Chinook Population Report. California Department of Fish and Wildlife, Fisheries Branch. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=84381&inline=1

BAAQMD (Bay Area Air Quality Management District). 2014. Meteorological data: Rio Vista Site Site ID 8901, 1989-2014. http://hank.baaqmd.gov/tec/data/metdata8901.html

Barrett, J. C., G. D. Grossmand, and J. Rosenfeld. 1992. Turbidity-induced changes in reactive distance of rainbow trout. Transactions of the American Fisheries Society 121: 437–443.

BASF Corporation. 2014. Habitat herbicide. Material safety data sheet. 30235835/SDS_CPA_US/EN. http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=7136

Beamesderfer, R. P. and M. H. Webb. 2002. Green sturgeon status review information. Prepared for State Water Contractors by S. P. Cramer and Associates, Inc.

Benoit, J., C. Gilmour, A. Heyes, R. P. Mason, and C. Miller. 2003. Geochemical and biological controls over methylmercury production and degradation in aquatic ecosystems. Pages 262-297 in Y. Chai and O. C. Braids, editors. Biogeochemistry of environmentally important trace elements. ACS Symposium Series No. 835. American Chemical Society, Washington, D. C.

Bergamaschi, B. A., J. A. Fleck, B. D. Downing, E. Boss, B. Pellerin, N. K. Ganju, D. H. Schoellhamer, A. A. Byington, W. A. Heim, M. Stephenson, and R. Fujii. 2011. Methyl mercury dynamics in a tidal wetland quantified using in situ optical measurements. Limnology and Oceanography 56(4): 1344-1371.

Bergamaschi, B.A., J. A. Fleck, B. D. Downing, E. Boss, B. A. Pellerin, N. K. Ganju, D. H. Schoellhamer, A. A. Byington, W. A. Heim, M. Stephenson, and R. Fujii. 2012. Mercury dynamics in a San Francisco Esutary tidal wetland: assessing dynamics using in situ measurements. Estuaries and Coasts 35(4):1036-1048

Betchart, W. 2008. Delta levees – types, uses, and policy options. Prepared for Delta Vision, California Resources Agency. http://deltavision.ca.gov/ConsultantReports/Delta_VisionLeveesReport_Final_08-07-08.pdf

Bonds, C. L. 2014. Senior Engineering Geologist, DWR, Sacramento. E-mail to T. Stevens, CDFW. June 5, 2014.

Brett, J. R., W. C. Clarke, and J. E. Shelbourn. 1982. Experiments on thermal requirements for growth and food conversion efficiency of juvenile chinook salmon *Oncorhynchys tshawytscha*. Canadian Technical Report of Fisheries and Aquatic Sciences 1127.

Brode, J., and G. Hansen. 1992. Status and future management of the giant garter snake (*Thamnophis gigas*) within the southern American Basin, Sacramento and Sutter counties, California. California Department of Fish and Game, Inland Fisheries Division.

Brown, L. R., J. K.Thompson, K. Higgens, and L. V. Lucas. 2007. Population density, biomass, and age-class structure of the invasive clam *Corbicula fluminea* in rivers of the lower San Joaquin River watershed, California. Western North American Naturalist 67(4): 572-586.

Bruce, B. 2008. Cultural resource report for the Prospect Island Levee System, Excess Property Project, Solano County, California. Northwest Information Center Report S-019945. U.S. Bureau of Reclamation, Mid-Pacific Region.

Bryan, K.. 1923. Geology and groundwater resources of Sacramento Valley, California. U.S. Geological Survey Water-Supply Paper 495.

Bryant, W. A. and E. W. Hart. 2007. Fault-rupture hazard zones in California. Alquist-Priolo Earthquake Fault Zoning Act, with index to earthquake fault zones maps. California Geological Survey, Special Publication 42, interim revision 2007. ftp://ftp.consrv.ca.gov/pub/dmg/pubs/sp/Sp42.pdf

Burnett, R. D. and J. DeStaebler. 2003. Songbird monitoring of lower clear creek floodway restoration project: 2002 report. PRBO Contribution # 1098, Stinson Beach, CA.

CAL FIRE. 2007. Solano County Fire Hazard Severity Zone map. http://www.fire.ca.gov/fire_prevention/fhsz_maps_solano

California Department of Conservation. 2012. Map of Solano County Important Farmland. ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/pdf/2012/sol12.pdf

California Department of Conservation. 2014. Map of California earthquake fault zones, and landslide and liquefaction zones. http://www.quake.ca.gov/gmaps/WH/regulatorymaps.htm

CalRecycle (California Department of Resources Recycling and Recovery). 2006. Targeted statewide waste characterization study: detailed characterization of commercial self-haul and drop-box waste. Sacramento. Prepared by Cascadia Consulting Group. Tiered Regulatory Placement Criteria.

Caltrans. 2004. Transportation- and construction-induced vibration guidance manual. Prepared for California Department of Transportation Noise, Vibration, and Hazardous Waste Management Office by Jones & Stokes, Sacramento, CA, June 2004. http://www.dot.ca.gov/hq/env/noise/pub/vibrationmanFINAL.pdf

Caltrans. 2009. Technical noise supplement. Prepared for California Department of Transportation Divison of Environmental Analysis by ICF Jones & Stokes, Sacramento, CA. http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf

CARB (California Air Resources Board). 2013. National and California ambient air quality standards. http://www.arb.ca.gov/research/aaqs/aaqs2.pdf

CARB. 2015. Aerometric data analysis and management. http://www.arb.ca.gov/adam/

Carpenter, R. S., J. F. Kitchell, and J. R. Hodgson. 1985. Cascading trophic interactions and lake productivity. BioScience 35: 634–639.

Carlson, P. 2015. Associate Right of Way Agent, DWR, Sacramento (CA). March 26 2015 --- e-mail communication with Gina Benigno, Environmental Scientist, DWR, West Sacramento (CA).

Casper, B. M., A. N. Popper, F. Matthews, T. J. Carlson, and M. B. Halvorsen. 2012. Recovery of barotrauma injuries in Chinook salmon, *Oncorhynchus tshawytscha*, from exposure to pile driving sound. PLOS ONE 7(6):e39593.

cbec and WWR (cbec and Wetlands and Water Resources). 2012. Prospect Island tidal habitat restoration project overflow weir design. Prepared for California Department of Water Resources. Technical Memorandum. July 18.

CDFG (California Department of Fish and Game). 1977. Minor Slough management plan. CDFG Region 2.

CDFG. 1994. Staff report regarding mitigation for impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California. Memorandum to CDFG Division Chiefs and Regional Managers from R. Rempel. Sacramento.

CDFG. 2005a. California Department of Fish and Game project review guidelines for delta smelt, winter-run Chinook salmon, and spring-run Chinook salmon protection in the Sacramento-San Joaquin Estuary. Prepared by California Department of Fish and Game, Central Valley Bay-Delta Branch.

CDFG. 2005b. The status of rare, threatened, and endangered plants and animals of California 2000-2004. California Department of Fish and Game.

CDFG and Yolo Basin Foundation. 2008. Yolo Bypass Wildlife Area Land Management Plan. Prepared in association with EDAW.

CDFW. 2013. Lindsey Slough Tidal Marsh Wetland Enhancement Project. Initial study and mitigated negative declaration. Prepared by Life Science!

CDFW. 2014a. Striped bass study and sturgeon study (data set accessed April 2014).

CDFW 2014b. Fall Midwater Trawl status and trends graph http://www.dfg.ca.gov/delta/data/fmwt/Indices/sld003.asp

CDFW. 2014c. California Natural Diversity Data Base. RareFind (computer application). Sacramento. http://www.dfg.ca.gov/biogeodata/cnddb/

CDPH (California Department of Public Health). 2011. Western black-legged tick (*Ixodes pacificus)* collection locations, California. Vector Borne Disease Section. November 2011.
http://www.cdph.ca.gov/HealthInfo/discond/Documents/MapIpacinCA2011.pdf

CDPR (California Department of Pesticide Regulation). 2013. Pesticide Registration Chemical/Label Database, Sacramento, California.CGS (California Geological Survey). 2010a. Fault activity map of California. Compilation and interpretation by C. W. Jennings and W. A. Bryant, with assistance from G. Saucedo. California Geologic Data Map Series, Map No. 6. Scale 1:750,000. http://www.consrv.ca.gov/cgs/cgs_history/Pages/2010_faultmap.aspx.

CGS. 2010b. Geologic map of California. Original compilation by C. W. Jennings; updated by C. Gutierrez, W. Bryant, G. Saucedo, and C. Wills. California Geologic Data Map Series, Map No. 2. Scale 1:750,000. http://www.consrv.ca.gov/cgs/cgs_history/Pages/2010_geologicmap.aspx.

CGS. 2013. Probabilistic Seismic Hazards Assessment (PSHA), ground motion map. PSHA Model 2002, revised April 2003. http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamap.asp

Choe, K.-Y., and G. A. Gill. 2003. Distribution of particulate, colloidal, and dissolved mercury in San Francisco Bay estuary. 2. Monomethyl mercury. Limnology and Oceanography 48:1547-1556. http://www.aslo.org/lo/toc/vol_48/issue_4/1547.pdf

Choe, K.-Y., G. A. Gill, and R. Lehman. 2003. Distribution of particulate, colloidal, and dissolved mercury in San Francisco Bay estuary. 1. Total mercury. Limnology and Oceanography 48:1535-1546. http://www.aslo.org/lo/toc/vol_48/issue_4/1535.pdf

City of West Sacramento. 2013. Port of West Sacramento business plan. California. March 2013. http://www.cityofwestsacramento.org/documents/port/PortBusinessPlan.pdf

Clarke, C. W. and J. E Shelbourn. 1985. Growth and development of seawater adaptability by juvenile fall Chinook salmon (*Oncorhynchus tshawytscha*) in relation to temperature. Aquaculture 45: 21-31.

Clinkenbeard, J. P. 2012. Aggregate sustainability in California: fifty-year aggregate demand compared to permitted aggregate reserves. California Geological Survey Map Sheet 52. http://www.conservation.ca.gov/cgs/information/publications/ms/Documents/MS_52_2012.pdf

CNPS. 2014. Inventory of Rare and Endangered Plants. Online dateabase. http://www.rareplants.cnps.org/

Coastal and Ocean Working Group of the California Climate Action Team. 2013. State of California Sea-Level Rise Guidance Document. Report developed by the Coastal and Ocean Working Group of the California Climate Action Team with science support provided by the Ocean Protection Council's Science Advisory

Team and the California Ocean Science Trust. March 2013 update. 13 p. http://www.opc.ca.gov/webmaster/ftp/pdf/docs/2013_SLR_Guidance_Update_FINAL1.pdf

Comrack, L. A. 2008. Yellow-breasted chat (*Icteria virens*). *In* W. D. Shuford and T. Gardali, editors. California bird species of special concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of western birds no. 1. Western Field Ornithologists, Camarilla, California and California Department of Fish and Game, Sacramento, California.

Cramer, S. S. and D. B. Demko. 1996. The status of late-fall and spring chinook salmon in the Sacramento River basin regarding the Endangered Species Act. Special Report. Prepared on behalf of Association of California Water Agencies and California Urban Water Agencies.

Crawford, H. S., R. G. Hooper, and R. W. Titterington. 1981. Song bird population response to silvicultural practices in central Appalachian hardwoods. Journal of Wildlife Management 45: 680–692.

Cubasch, U., D. Wuebbles, D. Chen, M. C. Facchini, D. Frame, N. Mahowald, and J.-G. Winther. 2013. Introduction. *In* T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley, editors. Climate change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, England.

Cummings, K. S and D. L. Graf. 2010. Mollusca: bivalvia. Pages 309-384 in J. H. Thorp, and A. P. Covich, editors. Ecology and classification of North American freshwater invertebrates. Academic Press, New York.

CVRWQCB (Central Valley Regional Water Quality Control Board). 2000. Salinity: A Literature Summary for Developing Water Quality Objectives (Draft). Central Valley Regional Water Quality Control Board, January. http://www.waterboards.ca.gov/centralvalley/water_issues/swamp/historic_reports_and_faq_sheets/info_supt_rec_guidelines/davis2000_salinity_litsum_ar07019.pdf

CVRWQCB 2011. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region, Fourth edition

(revised October 2011)..
http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans

CVRWQCB. 2000. Salinity: A Literature Summary for Developing Water Quality Objectives (Draft).

CVRWQCB (Central Valley Regional Water Quality Control Board), CDFW (California Department of Fish and Wildlife), and Delta Protection Commission. 2002. Delta dredging and reuse strategy. Volume I. Prepared by CVRWQCB, CDFW, and Delta Protection Commission, Sacramento, California.

Davis, J.N. and C.A. Niemela. 2008. Northern Harrier (*Circus cyaneus*) *In* W. D. Shuford and T. Gardali, editors. California bird species of special concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Dawson, T. E. 2009. Preliminary geologic map of the Lodi 30' x 60' quadrangle, California. California Geological Survey. Scale 1:100,000.
ftp://ftp.consrv.ca.gov/pub/dmg/rgmp/Prelim_geo_pdf/Lodi_100K_prelim.pdf

Delta Protection Commission. 2010. Delta Land Use and Resource Management Plan for the Primary Zone of the Delta. Adopted February 25.
http://www.delta.ca.gov/plan.htm

Delta Stewardship Council. 2013. Protect and enhance the unique cultural, recreational, natural resource, and agricultural values of the California Delta as an evolving place. Chapter 5 *in* Delta Plan, Adopted May 16, 2013. Sacramento, California.
http://deltacouncil.ca.gov/sites/default/files/documents/files/CH_05_2013.pdf

Deverel, S. J. and Leighton, D. A. 2010. Historic, recent and future subsidence, Sacramento-San Joaquin Delta, California, USA. San Francisco Estuary and Watershed Science 8(2).
http://www.escholarship.org/uc/item/7xd4x0xw

DOGGR (California Division of Oil, Gas, and Geothermal Resources). 1992. Penetration chart –gas fields of the Sacramento Valley. Publication No. TR44.

California Resources Agency, Department of Conservation, Division of Oil, Gas, and Geothermal Resources.

DOGGR. 2007. Well review program: introduction and application. California Resources Agency, Department of Conservation, Division of Oil, Gas, and Geothermal Resources.

DOGGR. 2011. Development, regulation, and conservation of oil and gas resources, Chapter 4 *in* California Code of Regulations. California Resources Agency, Department of Conservation, Division of Oil, Gas, and Geothermal Resources. ftp://ftp.consrv.ca.gov/pub/oil/regulations/PRC04_January_11.pdf

DOGGR. 2014. Well Finder Web Viewer. California Resources Agency, Department of Conservation, Division of Oil, Gas, and Geothermal Resources. http://maps.conservation.ca.gov/doggr/index.html

Domagalski, J. L., 1998. Occurrence and transport of total mercury and methyl mercury in the Sacramento River Basin, California. Journal of Geochemical Exploration 64: 277–291.

Domagalski, J. 2001. Mercury and methylmercury in water and sediment of the Sacramento River Basin, California. Applied Geochemistry 16: 1677-1691.

DOT (U.S. Department of Transportation). 2006. Transit noise and vibration impact assessment. Federal Highway Administration.

Downs, J. 2014. Personal Communication. Senior Environmental Scientist (Specialist), CDFW, Sacramento, CA. June 17, 2014 Prospect Island VELB survey report writeup.

DPR (California Department of Parks and Recreation). 1976. California Inventory of Historic Resources. Sacramento.

DPR. 2011. Recreation proposal for the Sacramento-San Joaquin Delta and Suisun Marsh. Sacramento.

Drexler, J. Z. 2011. Peat formation processes through the millennia in tidal marshes of the Sacramento–San Joaquin Delta, California, USA. Estuaries and Coasts 34: 900–911.

DTSC (California Department of Toxic Substance Control) 2015. EnviroStor map of Prospect Island vicinity. http://www.envirostor.dtsc.ca.gov/public/ Accessed: Feb. 18, 2015.

Dunk, Jeffrey R. 1995. White-tailed Kite (*Elanus leucurus*). *In* A. Poole, editor. The Birds of North America Online. Cornell Lab or Ornithology, Itheca. Retrieved from the Birds of North America: http://bna.birds.cornell.edu/bna/species/178

DWR (California Department of Water Resources). 1996. Water quality conditions in the Sacramento-San Joaquin Delta 1970-1993. Sacramento.

DWR. 2003. California's groundwater. Bulletin 118. http://www.water.ca.gov/groundwater/bulletin118/bulletin118update2003.cfm.

DWR. 2004. Methodology for flow and salinity estimates in the Sacramento-San Joaquin Delta and Suisun Marsh. Twenty-Fifth Annual Progress Report to the State Water Resources Control Board.

DWR. 2009. Prospect Island natural gas wells; evaluation of potential environmental threat. Memorandum. July 8, 2009. Brent Lamkin, Senior Engineering Geologist, DWR-DOE-Project Geology Section.

DWR. 2012a. Prospect Island chain of title. DWR Cadastral Unit.

DWR. 2012b. Status of levee heights for Delta islands. Memorandum prepared for the Delta Stewardship Council by Dave Mraz, DWR, Delta Levees and Environmental Engineering Branch. http://deltacouncil.ca.gov/delta-maps

DWR. 2012c. Initial study and draft negative declaration, California Department of Water Resources Draft Climate Action Plan Phase 1: Greenhouse Gas Emissions Reduction Plan.

DWR. 2013a. Notice of preparation of a draft environmental impact report, Prospect Island Tidal Habitat Restoration Project. Sacramento.

DWR. 2013b. Bay Delta Conservation Plan. Public Draft. November. Sacramento, CA. Prepared by ICF International (ICF 00343.12). Sacramento, CA. http://baydeltaconservationplan.com/PublicReview/PublicReviewDraftBDCP.aspx

DWR. 2014a. Preliminary wetland delineation for the Prospect Island Tidal Habitat Restoration Project, Solano County, California. Draft Report June 2014. Prepared by Stillwater Sciences for DWR, West Sacramento. Contract No. 4200009291. Stillwater Sciences, Davis, California.

DWR. 2014b. Site characterization and groundwater monitoring data analysis summary, Prospect Island Tidal Habitat Restoration Project, Solano County, California. Memorandum Report. DWR, North Central Region.

DWR. 2014c. Prospect Island Title Report Map. Exhibit Map - Drawing Number K-9D-21 and K-9D-44.

DWR. 2014d. Phase I Environmental Site Assessment. Fish Restoration Program Agreement – South Prospect Island Acquisition. Solano County, California.

DWR. 2015. Temporary Barriers Program Home. Temporary Barriers Project. South Delta Branch, Bay-Delta Office. http://baydeltaoffice.water.ca.gov/sdb/tbp/index_tbp.cfm

DWR and CDFG. 2008. Risks and options to reduce risks to fishery and water supply uses of the Sacramento/San Joaquin Delta.

DWR and CDFW. 2014. Prospect Island Tidal Habitat Restoration Project: Conceptual Restoration Plan. Final. Contract No. 4200009291. DWR, Sacramento District Office, Sacramento and CDFW, Office of Fish and Wildlife, Sacramento. Prepared with assistance from Stillwater Sciences, Davis, California and Wetlands and Water Resources, Inc., San Francisco, California. September.

DWR and California State Coastal Conservancy. 2008. Dutch Slough Tidal Marsh Restoration Project. Draft Environmental Impact Report. Prepared for DWR, Sacramento, California, and the California State Coastal Conservancy, Oakland, California. Prepared by Grassetti Environmental Consulting, Berkeley, California. SCH# 2006042009. November 2008. http://www.water.ca.gov/floodsafe/fessro/environmental/dee/docs/DS_DEIR_CoverExecSum.pdf

DWR and California State Coastal Conservancy. 2014. Dutch Slough Tidal Marsh Restoration Project. Final Supplemental Environmental Impact Report. Prepared for DWR, Sacramento, California, and the California State Coastal

Conservancy, Oakland, California. Prepared by Grassetti Environmental Consulting, Berkeley, California. SCH# 2006042009. September 2014. http://www.water.ca.gov/floodsafe/fessro/environmental/dee/docs/DS_FinalSEIR_FullDoc.pdf

DWR et al. (DWR, USBR, NMFS, and USFWS). 2013. Draft Environmental Impact Report/Environmental Impact Statement for the Bay Delta Conservation Plan. Prepared by ICF International (ICF 006742.12). Sacramento, California. http://baydeltaconservationplan.com/PublicReview/PublicReviewDraftEIR-EIS.aspx

eBird. 2013. Online database for California. Audubon California, PRBO, and the Cornell Lab of Ornithology. http://ebird.org/content/ca

Eckerle, K. P., and C. F. Thompson. 2001. Yellow-breasted Chat (*Icteria virens*), *In* A. Poole, editor. The Birds of North America Online. Cornell Lab or Ornithology, Itheca. Retrieved March 2015 from: http://bna.birds.cornell.edu/bna/species/575

Eddleman, W. R., R. E. Flores, and M. L. Legare. 1994. Black Rail (*Laterallus jamaicensis*). *In* A. Poole and F. Gill, editors. The Birds of North America, No. 123. Philadelphia: The Academy of Natural Sciences, Philadelphia, Pennsylvania and The American Ornithologists' Union, Washington, D.C.

Ekstrom, J. A., and S. C. Moser. 2012. Climate change impacts, vulnerabilities, and adaptation in the San Francisco Bay area: a synthesis of PIER Program reports and other relevant research. Publication CEC-500-2012-071. California Energy Commission. http://www.energy.ca.gov/2012publications/CEC-500-2012-071/CEC-500-2012-071.pdf)

England, A. S., M. J. Bechard, and C. S . Houston. 1997. Swainson's Hawk (*Buteo swainsoni*). *In* A. Poole and F. Gill, editors. The birds of North America, No. 265. The American Ornithologists' Union, Washington, D. C.

Federal Interagency Committee on Noise. 1992. Federal agency review of selected airport noise analysis issues.

Feyrer, F., Sommer, T. R., and Baxter, R. D. 2005. Spatial-temporal distribution and habitat associations of age-0 splittail in the lower San Francisco Estuary watershed. Copeia 5:159-168.

Fischenich, C. 2001. Stability thresholds for stream restoration materials. ERDC Technical Note EMRRP-SR-29. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Fisheries Hydroacoustic Working Group. 2008. Agreement in principle for interim criteria for injury to fish from pile driving activities. Memorandum.

Fitzgerald, W. F., D. R. Engstrom, R. P. Mason, and E. A. Nater. 1998. The case for atmospheric mercury contamination in remote areas. Environmental Science and Technology 32:1-7.

Fonss, J. 2014. Personal communication. Owner, Arrowhead Harbor Marina. Conversation with Douglas Rischbieter, Senior Environmental Scientist, California Department of Water Resources. May 21.

Gardali, T. 2008. Song sparrow (*Melospiza melodia*) ("Modesto" population). *In* W. D. Shuford and T. Gardali, editors. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Garza, J. C., and D. E. Pearse. 2008. Population genetic structure of *Oncorhynchus mykiss* in the California Central Valley. Final Report for California Department of Fish and Game Contract PO485303.

Gilmour, C. C., E. A. Henry, and R. Mitchell. 1992. Sulfate stimulation of mercury methylation in freshwater sediments. Environmental Science and Technology 26: 2281–2287.

Google Earth. 2014. Prospect Island (38° 16'10.35"N; 121° 39'11.76"W). June 1993 aerial imagery. Accessed May 2014.

Graymer, R. W., B. C. Moring, G. J. Saucedo, C. M. Wentworth, E. E. Brabb, and K. L. Knudsen. 2006. Geologic map of the San Francisco Bay region. U.S. Geological Survey Scientific Investigations Map 2918. http://pubs.usgs.gov/sim/2006/2918/

Grimaldo, L. and Z. Hymanson. 1999. What is the impact of the introduced Brazilian waterweed *Egeria densa* to the Delta ecosystem? Interagency Ecological Program for the San Francisco Estuary Newsletter 12(1).

Hagen, C. 2014. Personal communication. Wildlife Habitat Supervisor, California Department of Fish and Wildlife. Stockton. Conversation with Douglas Rischbieter, September 22.

Hagen, C. 2014. Personal communication. Wildlife Habitat Supervisor, California Department of Fish and Wildlife. Stockton. Conversation with Donald Guy, DWR. March 2014.

Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, and B. Thompson. 2011. Managing California's water: from conflict to reconciliation. Public Policy Institute of California, San Francisco. http://www.ppic.org/content/pubs/report/R_211EHR.pdf

Hansen, G. E. 1986. Status of the giant garter snake *Thamnophis couchii gigas* (Fitch) in the southern Sacramento Valley during 1986. Final report. Standard Agreement No. C-1433. Prepared for California Department of Fish and Game, Sacramento.

Hansen, G. E. 1988. Review of the status of the giant garter snake (*Thamnophis couchi gigas*) and its supporting habitat during 1986-1987. Final report, Contract C-2060. Prepared for California Department of Fish and Game.

Hansen, G. E., and J. M. Brode. 1980. Status of the giant garter snake, *Thamnophis couchi gigas*. Special Publication Report No. 80-5. California Department of Fish and Game, Inland Fisheries Endangered Species Program.

Hansen, G. E., and J. M. Brode. 1993. Results of relocating canal habitat of the giant garter snake (*Thamnophis gigas*) during widening of SR 99/70 in Sacramento and Sutter Counties, California. Interagency Agreement 03E325 (FG7550) (FY 87/88-91-92). Final report for Caltrans.

Hanson, C. H. 1997. Acute temperature tolerance of juvenile Chinook salmon from the Mokelumne River. Hanson Environmental Inc.

Harden, D. R. 2004. California geology. Second edition. Pearson Education. Upper Saddle River, New Jersey.

Heath, S. 1998. Yellow Warbler (*Dendroica petechia*). *In* The riparian bird conservation plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. Point Reyes Bird Observatory, Stinson Beach, California.

Heath, S. K. 2008. Yellow Warbler (*Dendroica petechia*). *In* W. D. Shuford and T. Gardali, editors. California bird species of special concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of western birds no. 1. Western Field Ornithologists, Camarilla, California and California Department of Fish and Game, Sacramento, California.

Helley, E. J., K. R. Lajoie, W. E. Spangle, and M. L. Blair. 1979. Flatland deposits of the San Francisco Bay region, California – their geology and engineering properties, and their importance to comprehensive planning. U.S. Geologic Survey Professional Paper 943.

Hester, M. W., J. M. Willis, and T. M. Sloey. 2013. Insights into colonization and expansion dynamics of tule marsh at Liberty Island, California. Presentation. Final products meeting for Breach III: evaluating and predicting ‘restoration thresholds’ in evolving freshwater-tidal marshes. https://sites.google.com/a/uw.edu/breach-iii/emerging-products/presentations

Holland, R. F. 1994. The western pond turtle: habitat and history. Final Report DOE/BP-62137-1. Bonneville Power Administration and Oregon Department of Fish and Wildlife, Wildlife Diversity Program, Portland.

Hopf, F. 2011. Levee Failures in the Sacramento San-Joaquin River Delta: Characteristics and perspectives. Doctoral dissertation. Geology Department, Texas A&M.

Hussey, B. H., and W. E. Odum. 1992. Evapotranspiration in tidal marshes. Estuaries 15:59-67.

Isaac, J. 2014. Personal communication. OES Office Assistant III, Solano County OES. Call from Michele King, Grassetti Environmental Consultants. March 5, 2014.

Jackson, Z. J., and J. P. Van Eenennaam. 2013. 2012 San Joaquin River sturgeon spawning survey. Final Annual Report. U. S. Fish and Wildlife Service, Stockton Fish and Wildlife Office, Anadromous Fish Restoration Program, Lodi.

Jaramillo, A. 2008. Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*). *In* D. Shuford and T. Gardali, editors. California bird species of special concern. Studies of Western Birds No. 1. Western Field Ornithologists, Camarillo, California and California Department of Fish and Game, Sacramento, California.

Jassby, A. D., J. E. Cloern, and B. E. Cole. 2002. Annual primary production: patterns and mechanisms of change in a nutrient-rich tidal ecosystem. Limnology and Oceanography 47: 698-712.

Jennings, M. R. and M. P. Hayes. 1994. Amphibian and reptile Species of Special Concern in California. California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova.

Jennings, M. R., M. P. Hayes, and D. C. Holland. 1992. A petition to the U.S. Fish and Wildlife Service to place the California red-legged frog (*Rana aurora draytonii*) and the western pond turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants. Department of Herpetology, California Academy of Science, San Francisco, California and Department of Biology, University of Southwestern Louisiana, Lafayette.

Junk, W. J., P. B. Bayley, and R. E. Sparks. 1989. The flood pulse concept in river-floodplain systems. *In* D. P. Dodge, editor. Proceedings of the international large river symposium. Canadian Special Publication of Fisheries and Aquatic Science 106: 110-127.

Kerin, E. J., C. C. Gilmour, E. Roden, M. T. Suziki, J. D. Coates, and R. P. Mason. 2006. Mercury methylation by dissimilatory iron-reducing bacteria. Applied and Environmental Microbiology 72: 7919-7921.

Kinnetic Laboratories. 2015. Sampling and Analysis Plan - Evaluation of Miner Slough Spur Channel Dredge Material, Prospect Island Tidal Habitat Restoration Project. Prepared for California Dept. of Water Resources. Contract No. C51464. Prepared by Kinnetic Laboratories, Inc. Santa Cruz, California. February 25

Klimley A. P., P. J. Allen, J. A. Israel, and J. T. Kelly. 2007. The green sturgeon and its environment: introduction. Environmental Biology of Fishes 79: 187-190.

Kramer-Wilt, E. 2010. Habitat preferences and interactions with macrobenthos of the non-indigenous Asian clam, *Corbicula fluminea*, in a restoring freshwater tidal marsh, Sacramento River delta. Doctoral dissertation. University of Washington, Seattle.

Kroodsma, R.L. 1982. Bird community ecology on power-line corridors in east Tennessee. Biological Conservation 23:79-94.

Kus, B. 2002. Least Bell's Vireo (*Vireo bellii pusillus*). Pages 58–59 *in* T. Gardali, B. Rocco, K. Kreitinger, S. Scoggin, and V. Tonoilo, editors. The riparian bird conservation plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian_v-2.pdf

LaSalle, M., D. Clarke, J. Homziak, J. D. Lunz, and J. Fredette. 1991. A framework for assessing the need for seasonal restrictions on dredging and disposal operations. Technical Report D-91-1. Prepared for U.S. Army Corp of Engineers, Vicksburg, Mississippi.

Li, H., and S. L. Yang. 2009. Trapping effect of tidal marsh vegetation on suspended sediment, Yangtze Delta. Journal of Coastal Research 25:915-924.

Lopez, C. B., J. E. Cloern, T. S. Schraga, A. J. Little, L. V. Lucas, J. K. Thompson, and J. R. Burau. 2006. Ecological values of shallow-water habitats: implications for the restoration of disturbed ecosystems. Ecosystems 9:422-440.

Lowther, P. E., C. Celada, N. K. Klein, C. C. Rimmer, and D. A. Spector. 1999. Yellow Warbler (*Dendroica petechia*). Account No. 26 *in* A. Poole and F. Gill, editors. The birds of North America. Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington, DC.

Lowther, P., A. F. Poole, J. P. Gibbs, S. Melvin, and F. A. Reid. 2009. American Bittern (*Botauruslentiginosus*). *In* A. Poole, editor. The Birds of North America online. Ithaca: Cornell Lab of Ornithology, Ithaca, New York. http://bna.birds.cornell.edu/bna/species/018doi:10.2173/bna.18

Lucas, L. V. and J. K. Thompson. 2012. Changing restoration rules: Exotic bivalves interact with residence time and depth to control phytoplankton productivity. Ecosphere 3(12): Article 117.

Lundvall, D., R. Svanback, L. Persson, and P. Bystrom. 1999. Size-dependent predation in piscivores: interactions between predator foraging and prey avoidance abilities. Canadian Journal of Fisheries and Aquatic Sciences 56: 1285-1292.

MacWhirter, R. B., and K. L. Bildstein, 1996. Northern Harrier, *Circus cyaneus*. *In* A. Poole and F. Gill, editors. The birds of North America. Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington, DC.

Marshall, M. 2005. Delta juvenile fish monitoring project. Interagency Ecological Program Newsletter 18: 5-6.

Mattice, J. S., and L. L. Dye. 1975. Thermal tolerance of the adult Asiatic clam *Corbicula manilensis*. Oak Ridge National Laboratory, Environmental Sciences Division.

Mecum, W. L. 2005. Neomysis and Zooplankton monitoring. Interagency Ecological Program Newsletter 18: 10-15.

Melhop, P., and J. F. Lynch. 1986. Bird/habitat relationships along a successional gradient in the Maryland Coastal Plain. American Midland Naturalist 116: 225-239.

Melwani, A. R., S. N. Bezalel, J. L. Grenier, J. A. Hunt, A. H. Robinson, and J. A. Davis. 2007. The relationship between landscape features and sport fish mercury in the Sacramento–San Joaquin Delta watershed. SFEI Contribution 534. San Francisco Estuary Institute, Oakland, California. http://www.sfei.org/sites/default/files/Final%20FMP%20Landscape%20Report.pdf

Mitchell, C. P. J., and C. C. Gilmour. 2008. Methylmercury production in a Chesapeake Bay salt marsh. Journal of Geophysical Research 113. G00C04. doi:10.1029/2008JG000765.

Mitchell, C. P. J., T. E. Jordan, A. Heyes, and C. C. Gilmour. 2012. Tidal exchange of total mercury and methylmercury between a salt marsh and a Chesapeake Bay sub-estuary. Biogeochemistry 111: 583-600.

Monsanto Company. 2012. AQUAMASTER® Herbicide. Material Safety Data Sheet. Version 3.1. July 3.

Morgan-King, T. L., and D. H. Schoellhamer. 2013. Suspended-sediment flux and retention in a backwater tidal slough complex near the landward boundary of an estuary. Estuaries and Coasts 36: 300–318. http://ca.water.usgs.gov/pubs/Morgan-KingSchoellhamer2012.pdf

Mount, J., and R. Twiss. 2005. Subsidence, sea level rise, and seismicity in the Sacramento–San Joaquin Delta. San Francisco Estuary and Watershed Science 3, Issue 1, Article 5. http://escholarship.org/uc/item/4k44725p.

Moyle, P.B. 2002. Inland fishes of California. Revised and expanded. University of California Press, Berkeley and Los Angeles, California.

Moyle, P. B. 2002. Inland fishes of California. Revised edition. University of California Press, Berkeley.

Moyle, P. B., P. K. Crain, and K. Whitener. 2007. Patterns in the use of a restored California floodplain by native and alien fishes. San Francisco Estuary and Watershed Science 5(3).

Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake. 1995. Fish species of special concern in California. Second edition. Prepared for California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova.

Myrick, C. A., and Cech, J. J., Jr. 2001. Temperature effects on Chinook salmon and steelhead: a review focusing on California's Central Valley populations. Bay Delta Modeling Forum Technical Publication 01(1).

National Research Council. 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. The National Academies Press. 201 pgs. DOI: 10.17226/13389.

National Audubon Society. 2013. Audubon Important Bird Areas. Sacramento-San Joaquin Delta Site Profile. http://netapp.audubon.org/iba/Site/229.

National Petroleum Council. 2011. Plugging and abandonment of oil and gas wells. Paper 2-25. Working document of the National Petroleum Council North

American Resource Develepmont Study. Prepared by Technology Subgroup of the Operations and Environment Task Group. http://www.npc.org/Prudent_Development-Topic_Papers/2-25_Well_Plugging_and_Abandonment_Paper.pdf

NCSS (National Cooperative Soil Survey). 2012. Soil survey geographic (SSURGO) database. Google Earth-based mapping tool. http://casoilresource.lawr.ucdavis.edu/soilweb/

Newhart, K. 2013. Summary of new pesticide active ingredient use tracking for field monitoring in surface water from 2005-2010. CDPR, Environmental Monitoring Branch, Sacramento, California.

NMFS (National Marine Fisheris Service). 1993. Designated critical habitat; Sacramento River winter-run Chinook salmon; Final Rule. Federal Register 58: 33213-33219.

NMFS. 1998. Essential fish habitat: new marine fish habitat conservation mandate for federal agencies. EFH Federal Agency Primer. NMFS, Northeast Region, Gloucester, Massachusetts.

NMFS. 1999. Endangered and threatened species: threatened status for two chinook salmon evolutionarily significant units (ESUs) in California, final rule. Federal Register 64:50394-50415.

NMFS. 2005. Endangered and threatened species: designation of critical habitat for seven evolutionarily significant units of Pacific salmon and steelhead in California, final rule. Federal Register 70: 52488-52626.

NMFS. 2006a. Endangered and threatened species: final listing determination for 10 distinct population segments of West Coast steelhead, final rule. Federal Register 71:834-862.

NMFS. 2006b. Endangered and threatened wildlife and plants: threatened status for the southern distinct population segment of North American green sturgeon, final rule. Federal Register 71:17757-17766.

NMFS. 2009a. Biological opinion and conference opinion on the long-term operations of the Central Valley Project and the State Water Project. Prepared for U.S. Bureau of Reclamation. National Marine Fisheries Service, Southwest Region, Long Beach, CA. June 4.

NMFS. 2009b. Endangered and threatened wildlife and plants: final rulemaking to designate critical habitat for the threatened southern distinct population segment of North American Green Sturgeon, final rule. Federal Register 74: 52300-52351.

NOAA (National Oceanic and Atmospheric Administration). 2003. Computational techniques for tidal datums handbook. NOAA Special Publication NOS CO-OPS 2.

NOAA. 2014. Nautical chart 18662 California: Sacramento River Andrus Island to Sacramento. http://www.charts.noaa.gov/OnLineViewer/18662.shtml

Nobriga, M.L., and F. Feyrer. 2007. Shallow-water piscivore-prey dynamics in California's Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science: 5(2).

NPIC (National Pesticide Information Center). 2002. Triclopyr. General Fact Sheet. Oregon State University, Corvallis, Oregon. http://npic.orst.edu/factsheets/triclogen.pdf

NPS (National Park Service). 1997. Secretary of the Interior historic preservation professional qualifications standards. Federal Register 62: 33708-33723. U.S. Government Printing Office, Washington, D.C.

NRCS (Natural Resources Conservation Service). 2007. National Engineering Handbook Part 360: Hydrology. Chapter 7, Hydrologic soil groups. http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?cid=stelprdb1043063

Nufarm Americas, Inc. 2012. POLARIS herbicide. Material Safety Data Sheet. June 20. http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=9189&t=

OHP (Office of Historic Preservation). 2012a. Archaeological determinations of eligibility. OHP, California Department of Parks and Recreation, Sacramento.

OHP. 2012b. Historic property directory. OHP, California Department of Parks and Recreation, Sacramento.

Orr, M., S. Crooks, and P. Williams. 2003. Will restored tidal marshes be sustainable? San Francisco Estuary and Watershed Science 1(Issue 1). http://escholarship.org/uc/item/8hj3d20t

Orsi, J. J., and W. L. Mecum. 1996. Food limitations as the probable cause of a long-term decline in the abundance of *Neomysis mercedis* the opossum shrimp in the Sacramento-San Joaquin Estuary. Pages 375-401 *in* J. T. Hollibaugh, editor. San Francisco Bay: The ecosystem. San Francisco, California: Pacific Division, American Association for the Advancement of Science. p. 375-401.

Oregon State University. 2002. Imazapyr pesticide fact sheet: forestry use. National Institute of Environmental Health Services. Corvallis, Oregon. Updated by W. Trevathan. November. http://cms.oregon.gov/ODF/privateforests/docs/imazapyr.pdf

Palermo, M. R., J. Homziak, and A. M. Teeter. 1990. Evaluation of clamshell dredging and barge overflow, Military Ocean Terminal, Sunny Point, North Carolina. Technical Report D-90-6. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Parus Consulting. 2012. Cultural Resources Inventory and Effects Assessment for the Prospect Island Project, Solano County, California. Northwest Information Center Report #S-039290. Prepared for Stillwater Sciences and California Department of Water Resources.

Parus Consulting. 2014. Shipwreck survey of a portion of Miner Slough for the Prospect Island Project, Solano County, California. Prepared for California Department of Water Resources.

Perry, R. W., and J. R. Skalski. 2009. Migration and survival of juvenile Chinook salmon through the Sacramento–San Joaquin River Delta during the winter of 2007–2008. Technical Report. U.S. Fish and Wildlife Service, Stockton, California. http://www.fws.gov/stockton/jfmp/datareports.asp

Perry, R. W., P. L. Brandes, J. R. Burau, A. P. Klimley, B. MacFarlane, C. Michel, and J. R. Skalski. 2013. Sensitivity of survival to migration routes used by juvenile Chinook salmon to negotiate the Sacramento-San Joaquin River Delta. Environmental Biology of Fishes 96: 381–392.

Pierson, E. D., W. E. Rainey, and C. Corben. 2006. Distribution and status of western red bats (*Lasiurus blossevillii*) in California. Species Conservation and Recovery Program Report 2006-04. California Department of Fish and Game, Habitat Conservation Planning Branch, Sacramento.

Pimentel, D. 2005. Environmental and economic costs of the application of pesticides primarily in the United States. Environment, Development, and Sustainability 7: 229-252.

Pinto-Coelho, R.M. 1998. Effects of eutrophication on seasonal patterns of mesozooplankton in a tropical reservoir: a 4-year study in Pampulha Lake, Brazil. Freshwater Biology 40: 159-173.

Poirier, P. 2015. Personal Communication. Environmental Scientist, CDFW. Feb. 5, 2015 e-mail correspondence with G. Benigno, DWR

Rabidoux, A. A. 2013. Personal Communication. Water Resources Engineer, Solano County Water Agency. June 19, 2013 e-mail correspondence with M. Carter, Project Engineer, Wetlands and Water Resources.

Rankin, E. T. 1986. Habitat selection by smallmouth bass in response to physical characteristics in a natural stream. Transactions of the American Fisheries Society 115: 322-334.

Reclamation District 2093. 2009. Liberty Island conservation bank. Initial study/mitigated negative declaration April 2009.

Ricketts, M. and B. Kus. 2000. Yellow-breasted Chat (*Icteria virens*). *In* The riparian bird conservation plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. Point Reyes Bird Observatory, Stinson Beach, California.

Riordan, D. 2014. Personal Communication. Senior Environmental Scientist, Fish Restoration Program, DWR. West Sacramento, CA. July 7, 2014 --- e-mail correspondence with Nick Eide, Parus Consulting, Roseville, CA.

Roberson, D. 2008. Short-eared owl (*Asio flammeus*). *In* D. Shuford and T. Gardali, editors. California bird species of special concern. Studies of Western Birds No. 1. Western Field Ornithologists, Camarillo, California and California Department of Fish and Game, Sacramento, California.

Rochlin, I., M.-J. James-Pirri, S. C. Adamowicz, R. J. Wolfe, P. Capotosto, M. E. Demsey, T. Iwanejko, and D. V. Ninivaggi. 2012. Integrated Marsh Management (IMM): a new perspective on mosquito control and best management practices for salt marsh restoration. Wetlands Ecology and Management 20:219-232. http://link.springer.com/article/10.1007%2Fs11273-012-9251-9

Rytuba, J. J. 2000. Mercury mine drainage and processes that control its environmental impact. The Science of the Total Environment 260:57-71.

Schlorff, R., and P. H. Bloom. 1984. Importance of riparian systems to nesting Swainson's Hawks in the Central Valley of California. Pages 612–618 *in* R. E. Warner and K. M. Hendrix, editors. California riparian systems: ecology, conservation, and productive management. University of California Press, Berkeley.

Schoellhamer, D.H. 2011. Sudden Clearing of Estuarine Waters Upon Crossing the Threshold from Transport to Supply Regulation of Sediment Transport as an Erodible Sediment Pool is Depleted: San Francisco Bay, 1999. Estuaries and Coasts 34: 885-899. DOI 10.1007/s12237-01109382-x.

Schoellhamer, D. H., S. A. Wright, and J. Z. Drexler. 2012. Conceptual Model of Sediment in the Sacramento-San Joaquin River Delta. San Francisco Estuary and Watershed Science 10(3).

Schuette, J. 1998. Environmental fate of glyphosate. California Department of Pesticide Regulation, Environmental Monitoring and Pest Management, Sacramento. http://www.cdpr.ca.gov/docs/emon/pubs/fatememo/glyphos.pdf

SERA (Syracuse Environmental Research Associates). 2007. Aminopyralid. Human Health and Ecological Risk Assessment. Final report. USDA Contract AG-3187-C-06-0010. Prepared by SERA, Manlius, New York for USDA Forest Service, Southern Region, Atlanda, Georgia.

SERA (Syracuse Environmental Research Associates). 2011a. Glyphosate human health and ecological risk assessment. Final report. USDA Contract AG-3187-C-06-0010. Prepared by SERA, Manlius, New York for USDA Forest Service, Southern Region, Atlanta, Georgia.

SERA. 2011b. Imazapyr human health and ecological risk assessment. Final report. USDA Contract AG-3187-C-06-0010. Prepared Prepared by SERA, Manlius, New York for USDA Forest Service, Southern Region, Atlanta, Georgia. http://www.fs.fed.us/foresthealth/pesticide/pdfs/Imazapyr_TR-052-29-03a.pdf

SFCWA (State and Federal Contractors Water Agency). 2013. Lower Yolo Restoration Project. Final Environmental Impact Report.

Simenstad, C., J. Toft, H. Higgins, J. Cordell, M. Orr, P. Williams, L. Grimaldo, Z. Hymanson, and D. Reed. 2000. Sacramento/San Joaquin Delta Breached Levee Wetland Study (BREACH). Preliminary Report. Wetland Ecosystem Team, University of Washington, School of Fisheries, Seattle, Washington.

Slotton, D. G., S. M. Ayers, T. H. Suchanek, R. D. Weyand, A. M. Liston, C. Asher, D. C. Nelson, and B. Johnson. 2002. The effects of wetland restoration on the production and bioaccumulation of methylmercury in the Sacramento-San Joaquin Delta, California. *In* An assessment of human health and ecological impacts of mercury in the Bay-Delta watershed. Final Report. CALFED Bay-Delta Program.

Solano County. 2015. West Nile Virus activity begins in Solano County. Solano County, California website. http://www.solanocounty.com/news/displaynews.asp?NewsID=708&TargetID=1. Accessed: March 12, 2015.

Solano County Board of Supervisors. 2008. Solano County General Plan. Adopted on August 5, 2008. http://www.co.solano.ca.us/depts/rm/planning/general_plan.asp

Sommer, T., B. Harrell, M. Nobriga, R. Brown, P. Moyle, W. Kimmerer, and L. Schemel. 2001a. California's Yolo Bypass: evidence that flood control can be compatible with fisheries, wetlands, wildlife, and agriculture. Fisheries 26:6-16.

Sommer, T., M. L. Nobriga, B. Harrell, W. Batham, and W. J. Kimmerer. 2001b. Floodplain rearing of juvenile chinook salmon: evidence of enhanced growth and survival. Canadian Journal of Fisheries and Aquatic Sciences 58:325-333.

Sommer, T. R., W. C. Harrell, M. L. Nobriga, and R. Kurth. 2003. Floodplain as habitat for native fish: lessons from California's Yolo Bypass. Pages 81-87 *in* P.M. Faber, editor. California riparian systems: Processes and floodplain management, ecology, and restoration. 2001 Riparian habitat and floodplains conference proceedings, Riparian Habitat Joint Venture, Sacramento, California.

Sommer, T., and F. Mejia. 2013. A place to call home: a synthesis of delta smelt habitat in the upper San Francisco Estuary. San Francisco Estuary and Watershed Science 11. http://www.escholarship.org/uc/item/32c8t244

Sousa, R., C. Antunes, and L. Guilhermino. 2008. Ecology of the invasive Asian clam *Corbicula fluminea* in aquatic ecosystems: an overview. Annales de Limnologie 44: 85-94.

Strange, C.J. 2008. Troubling waters. BioScience 58(11): 1008-1113.

SWRCB (State Water Resources Control Board). 2000. Revised Water Right Decision 1641. December 29, 1999. revised March 15, 2000. http://www.waterboards.ca.gov/waterrights/board_decisions/adopted_orders/decisions/d1600_d1649.shtml

SWRCB. 2006. Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. Sacramento, California.

SWS and WWR (Stillwater Sciences and Wetlands & Water Resources). 2012. Prospect Island Tidal Restoration: Synthesis of Phase 1 screening-level modeling evaluation of conceptual restoration alternatives. Final Report. Prepared for California Department of Water Resources, West Sacramento by Stillwater Sciences, Davis, and Wetlands & Water Resources, Inc., San Rafael, California. Contract No. 4200009291.

SWS and WWR. 2013. Prospect Island invasive vegetation existing conditions assessment. Contract No. 4200009291. Prepared for California Department of Water Resources, West Sacramento by Stillwater Sciences, Davis, and Wetlands & Water Resources, Inc., San Rafael, California.

Systech Water Resources. 2011. Analytical Modeling of the Sacramento River. Task 3 Technical Memorandum. Prepared for California Urban Water Agencies (CUWA) and the Central Valley Drinking Water Policy Work Group. Prepared by Systech Water Resources, Inc., Walnut Creek, California.

Torres, R. A., N. A. Abrahamson, F. N. Brovold, G. Cosio, M. W. Driller, L. F. Harder, N. D. Marachi, C. H. Neudeck, L. M. O'Leary, M. Robsbotham, R. B.

Seed. 2000. Seismic vulnerability of the Sacramento -San Joaquin Delta levees. CALFED Bay-Delta Program.

Tucker, M. E., C. D. Martin, and P. D. Gaines. 2003. Spatial and temporal distribution of Sacramento pikeminnow and striped bass at the Red Bluff Diversion Complex, including the research pumping plant, Sacramento River, California: January 1997 to August 1998, Red Bluff Research Pumping Plant Report Series, Vol. 10. U.S. Fish and Wildlife Service and U.S. Bureau of Reclamation, Red Bluff, California.

University of Hertfordshire, 2013. Pesticide Properties DataBase, developed by the Agriculture & Environment Research Unit, University of Hertfordshire, 2006-2013. http://sitem.herts.ac.uk/aeru/ppdb/en/

URS. 2013. Geomorphic Assessment and Surficial Mapping of Prospect and Ryer Island, California. Technical Memorandum. Prepared for DWR, Division of Integrated Regional Water Management, Non-Urban Levee Evaluations Project.

URS et al. (URS, Jack R. Benjamin & Associates, Inc., and Phillip Williams & Associates, Ltd.) 2006. Delta Risk Management Strategy Initial Technical Framework Paper Windwaves. Prepared for Department of Water Resources. September 6.

USACE (U.S. Army Corps of Engineers). 1987. Confined disposal of dredged material, Engineer manual. EM 1110-2-5027. Washington, D.C. http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-5027.pdf

USACE. 2000. Design and construction of levees. EM-1110-2-1913. April 30.

USACE. 2003. Evaluation of dredged material proposed for disposal at island, nearshore, or upland confined disposal facilities—testing manual. Prepared by USACE, Vicksburg, Mississippi.

USACE. 2006. Sacramento River Flood Control Project Levee and Channel Profiles Map, Sheet 2 of 4. http://www.cvfpb.ca.gov/profiles/index.cfm

USACE. 2007. Yolo Bypass 2-D hydraulic model development and calibration. Engineering Documentation Report. U.S. Army Corps of Engineers, Sacramento District.

USACE and DWR (U.S. Army Corps of Engineers and California Department of Water Resources). 2001. Prospect Island Ecosystem Restoration Project, Solano County, California. Environmental Assessment/Initial Study.

USBR (U.S. Bureau of Reclamation). 2008. Phase I/II Environmental Site Assessment, Prospect Island. Sacramento, California.

USBR. 2013. Delta Cross Channel. Fact sheet. Mid-Pacific Region. http://www.usbr.gov/mp/PA/docs/fact_sheets/Delta_Cross_Channel_Canal.pdf

USBR and DWR (U.S. Bureau of Reclamation and California Department of Water Resources). 2005. Water Quality. Chapter 5, Section 5.3 *in* South Delta Improvements Program Volume 1. Draft Environmental Impact Statement/ Environmental Impact Report. Prepared by Jones and Stokes.

USBR et al. (USBR, USFWS, and CDFG). 2011. Water quality. Chapter 5, Section 5.2 *in* Suisun Marsh habitat management, preservation, and restoration plan. Final Environmental Impact Statement/Environmental Impact Report.

USEPA (U.S. Environmental Protection Agency). 1971. Noise from construction equipment and operations, building equipment, and home appliances. NTID 300.1.

USEPA. 2002. No Effect determination for Paraquat Dichloride for Pacific Anadramous Salmonids. Memorandum to Field and External Affiars Division from L. Turner. Washington DC. http://www.epa.gov/espp/litstatus/effects/ne_paraquat.pdf

USEPA. 2003. Species profile: American Bittern. http://www.epa.gov/region1/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_american_bittern.pdf

USEPA. 2006. Reregistration eligibility decision for imazapyr. EPA 738-R-06-007. OPP-2005-0495..

USEPA. 2007. Risks of imazapyr use to federally threatened California red-legged frog (*Rana aurora draytonii*). Pesticide effects determination. USEPA, Environmental Fate and Effects Division, Office of Pesticide Programs, Washington, D.C. http://www.epa.gov/oppfead1/endanger/litstatus/effects/redleg-frog/imazapyr/analysis.pdf

USEPA. 2008. Risks of glyphosate use to federally threatened California red-legged frog (*Rana aurora draytonii*). Environmental Fate and Effects Division, Office of Pesticide Programs, Washington, D.C.

USEPA 2014. Emission factors for greenhouse gas inventories. Last modified April 4. http://www.epa.gov/climateleadership/documents/emission-factors.pdf

USEPA and USACE. 1998. Evaluation of dredged material proposed for discharge in waters of the U.S.—testing manual. Inland Testing Manual. Prepared by USEPA and USACE, Washington, D.C.

USFWS (U.S. Fish and Wildlife Service). 1993a. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Giant Garter Snake. Federal Register 58:54053-54066.

USFWS. 1993b. Endangered and threatened wildlife and plants: determination of threatened status for the delta smelt, Final Rule. Federal Register 58: 12854-12864.

USFWS. 1994. Endangered and threatened wildlife and plants: critical habitat determination for the delta smelt, Final Rule. Federal Register 59: 65256-65279.

USFWS. 1999a. Conservation guidelines for the valley elderberry longhorn beetle. USFWS, Sacramento Fish and Wildlife Office, Sacramento, California. http://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/velb_conservation.pdf

USFWS. 1999b. Draft recovery plan for the giant garter snake (*Thamnophis gigas*). USFWS, Portland, Oregon. http://www.fws.gov/ecos/ajax/docs/recovery_plan/990702b.pdf

USFWS. 2003. Endangered and threatened wildlife and plants; notice of remanded determination of status for the Sacramento Splittail (Pogonichthys macrolepidotus), final rule. Federal Register 68: 55140-55166.

USFWS. 2004. Final programmatic consultation on the issuance of section 10 and 404 permits for projects with relatively small effects on the delta smelt

(*Hypomesus transpacificus*) and its critical habitat within the jurisdiction of the Sacramento Fish and Wildlife Office of the U.S. Fish and Wildlife Service, California. Document No. 1-1-04-F-0345. Prepared by USFWS, Sacramento Fish and Wildlife Office, Sacramento. http://www.fws.gov/sfbaydelta/documents/coe_delta_smelt.pdf

USFWS. 2008. Formal Endangered Species Act consultation on the proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP). Biological opinion. Prepared by USFWS, California and Nevada Region, Sacramento, California for U.S. Bureau of Reclamation, Central Valley Operations Office, Sacramento. http://www.fws.gov/sfbaydelta/cvp-swp/cvp-swp.cfm

USFWS. 2012. Giant garter snake (*Thamnophis gigas*) 5-year review: summary and evaluation. Sacramento, California.

USFWS. 2013. U. S. Fish and Wildlife Service's Species List Generator. http://www.fws.gov/sacramento/es_species/Lists/es_species_lists-overview.htm

USGS (U.S. Geological Survey). 1999. Earthquake probabilities in the San Francisco bay region: 2000 to 2030—a summary of findings. Open-File Report 99-517. Prepared by: Working Group on California Earthquake Probabilities. http://geopubs.wr.usgs.gov/open-file/of99-517/

USGS. 2013. Mineral resources data system: coterminous U.S. Online spatial database http://mrdata.usgs.gov/mineral-resources/mrds-us.html

Videler, J. J., and C. S. Wardle. 1991. Fish swimming stride by stride: speed limits and endurance. Reviews in Fish Biology and Fisheries 1:23-40.

Vogel, D. A. 2008. Pilot study to evaluate acoustic-tagged juvenile Chinook salmon smolt migration in the northern Sacramento-San Joaquin Delta, 2006-2007. Prepared for California Department of Water Resources by Natural Resources Scientists, Inc.

Vogel, D. 2011. Insights into the problems, progress, and potential solutions for Sacramento River Basin native anadromous fish restoration. Prepared for Northern California Water Association and Sacramento Valley Water Users by Natural Resource Scientists, Inc.

Wagner, D. L., C. W. Jennings, T. L. Bedrossian, and E. J. Bortugno. 1981. Geologic map of the Sacramento quadrangle, California. California Geological Survey, Regional Geologic Map 1A. Scale 1:250,000. http://ngmdb.usgs.gov/Prodesc/proddesc_520.htm

Walker, J. D., and J. W. Geissman. 2009. Geologic time scale. Geological Society of America. doi: 10.1130/2009.CTS004R2C. http://www.geosociety.org/science/timescale/

Welch, P. 1998. An evaluation of historic houses at Prospect Island, Sacramento-San Joaquin Delta, California. Northwest Information Center Report #S-019945. U.S. Bureau of Reclamation, Mid-Pacific Region.

Welch, P. 2007. Archaeological survey for the repair of two levees at Prospect Island and rehabilitation of erosion damage at Stringer Island, Solano County, California. U.S. Bureau of Reclamation, Mid-Pacific Regional Office, Sacramento.

Western Bat Working Group. 2007. Western Bat Working Group Regional Bat species Priority Matrix. http://www.wbwg.org/speciesinfo/species_matrix/spp_matrix.pdf

Whipple, A. A., R. M. Grossinger, D. Rankin, B. Stanford, and R. A. Askevold. 2012. Sacramento-San Joaquin Delta historical ecology investigation: exploring pattern and process. Prepared for California Department of Fish and Game and Ecosystem Restoration Program. SFEI-ASC Historical Ecology Program, Publication #672. San Francisco Estuary Institute, Aquatic Science Center, Richmond, California. http://www.sfei.org/DeltaHEStudy

Wiener, J. G., C. C. Gilmour, and D. P. Krabbenhoft. 2003. Mercury strategy for the Bay-Delta ecosystem: a unifying framework for science, adaptive management, and ecological restoration. Final report to California Bay Delta Authority, Contract 4600001642 between Association of Bay Area Governments and University of Wisconsin-La Crosse.

Windham-Myers, L., M. Marvin-DiPasquale, D. P. Krabbenhoft, J. L. Agee, M. H. Cox, P. Heredia-Middleton, C. Coates, and E. Kakouros. 2009. Experimental removal of wetland emergent vegetation leads to decreased methylmercury production in surface sediments. Journal of Geophysical Research 114, G00C05, http://dx.doi.org/10.1029/2008JG000815

Witzman, J. 2014. Personal Communication. Program Manager 1, DWR, Sacramento, CA. Jan. 16, 2014 e-mail correspondence with Megan Keever, Stillwater Sciences, Berkeley, California.

WWR and SWS. 2013. Prospect Island Tidal Restoration: Supplemental Phase 1 screening-level modeling results memorandum. Prepared for California Department of Water Resources, West Sacramento. by Stillwater Sciences, Davis, and Wetlands & Water Resources, Inc., San Rafael, California, with assistance from Resource Management Associates, Fairfield, California.

WWR and SWS. 2014. Phase 2 modeling synthesis report. Prospect Island Tidal Habitat Restoration Project. Final report, Contract No. 4200009291. Prepared by Wetlands and Water Resources, Inc., San Rafael and Stillwater Sciences, Davis, with assistance from Resource Management Associates, Fairfield, and Delta Modeling Associates, San Francisco, California for California Department of Water Resources, West Sacramento, California.

Wylie, G.D., and L.L. Martin. 2005. Surveys for giant garter snakes in Solano County: 2005 report. USGS, BRD, WERC Dixon Field Station.

Yolo Natural Heritage Program. 2009. Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) Draft species account. http://www.yoloconservationplan.org/yolo_pdfs/speciesaccounts/birds/yellow-headed-blackbird.pdf

YSAQMD (Yolo-Solano Air Quality Management District). 2007. Handbook for assessing and mitigating air quality impacts. Appendix A. Davis, California. http://www.ysaqmd.org/documents/CEQAHandbook2007.pdf

YSAQMD. 2014. Federal and state attainment status for the Yolo-Solano Air Quality Management District. http://www.ysaqmd.org/AttainmentPlanning.php

Zeiner, D. C., W. F. Laudenslayer Jr., K. E. Mayer, and M. White, editor. 1988. California's wildlife. Volume I. Amphibians and reptiles. California Statewide Habitat Relationships System. California Department of Fish and Game.

Zeiner, D. C., W. F. Laudenslayer Jr., K. E. Mayer, and M. White, editor. 1990a. California's wildlife. Volume III. Mammals. California Statewide Habitat Relationships System. California Department of Fish and Game.

Zeiner, D. C., W. F. Laudenslayer Jr., K. E. Mayer, and M. White, editor. 1990b. California's wildlife. Volume II. Birds. California Statewide Habitat Relationships System. California Department of Fish and Game.

Zucker, E. 1985. Hazard Evaluation Division - Standard Evaluation Procedure - Acute toxicity test for freshwater fish. U.S. EPA Publication 540/9-85-006. [cited in USEPA 2002: http://www.epa.gov/espp/litstatus/effects/ne_paraquat.pdf]

Zhang, M., and R. Goodhue. 2010. Agricultural pesticide best management practices report. Final report for Central Valley Regional Water Quality Control Board. University of California, Davis Agricultural GIS Laboratory.

Appendices

Appendix A

Distribution List, Comments, and Response to Comments

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Appendix B

Notice of Preparation and Scoping Report

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Appendix C

Summary of Technical Terms

Acre-foot: A common water industry unit of measurement. An acre-foot is 325,851 gallons, or the amount of water needed to cover one acre with water one foot deep. An acre-foot serves the annual needs of two typical California families.

Ammocoetes: Larval phase of lampreys.

Anadromous fish: Fishes, such as Chinook salmon, steelhead, and lampreys that are born in freshwater, who eventually migrate to the ocean to grow into adults, and then finally return to freshwater to spawn.

Aqueduct: A man-made canal or pipeline used to transport water.

Aquifer: An underground geologic formation of rock or soil that is naturally saturated with water; an aquifer stores groundwater.

Attainment: An air basin is considered to be in attainment for a particular air pollutant criteria if it meets federal and/or state standards set for that pollutant.

Backfill: Material used in refilling excavation, or the process of such refilling; also, material used to fill an excavated trench.

Basin Plan: Basin Plans (also called Water Quality Control Plans) provide the basis for protecting water quality in California, as mandated by both the federal Clean Water Act and the state Porter-Cologne Water Quality Act. These plans are designed to preserve and enhance water quality and protect the beneficial uses of all regional waters. Basin Plans typically:

1. Designate beneficial uses of all regional waters.
2. Establish narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's anti-degradation policy.
3. Describe implementation programs to protect the beneficial uses of all waters in the region.
4. Describe surveillance and monitoring activities to evaluate the effectiveness of the Basin Plans.

Bay-Delta: The Sacramento-San Joaquin Bay-Delta is a unique natural resource of local, state, and national significance. The Delta is home to more than 500,000 people; contains 500,000 acres of agriculture; provides habitat for 700 native plant and animal species; provides water for more than 25 million Californians and 3 million acres of agriculture; is traversed by energy, communications and transportation facilities vital to the economic health of California; and supports a $400 billion economy. This region comprises the entire estuary system of the San Francisco Bay, Sacramento and San Joaquin rivers, and the delta formed by those two rivers.

Bay Delta Conservation Plan: A forthcoming conservation plan prepared to meet the requirements of the federal and state Endangered Species Acts and/or the Natural Community Conservation Plan Act to meet the State of California’s co-equal goals of a more reliable water supply in California and a comprehensive restoration program for the Bay-Delta region.

Beneficial use: “Beneficial uses” of the waters of the State of California that may be protected against water quality degradation including, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

Benthic: This term refers to the bottom of rivers, lakes, or oceans.

Berm: A horizontal strip or shelf built into an embankment or cut to break the continuity of the slope, usually for the purpose of reducing erosion or to increase the thickness of the embankment at a point of change in a slope or defined water surface elevation.

Best management practices: An engineered structure or construction management activity, or combination of these strategies that eliminates or reduces the Project’s potentially adverse environmental impacts.

Bioaccumulation: The intake and retention of nonfood substances by a living organism from its environment, resulting in a build-up of the substances in the organism.

Biological opinion: Document issued under the authority of the federal Endangered Species Act stating the U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS) finding as to whether a federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of designated critical habitat. As part of the biological opinion, the federal agencies prepare reasonable and prudent alternatives (RPAs) that direct the lead agency or project applicant to implement specific actions to reduce effects that may threatened or endanger listed species.

Brackish water: This type of water is a mixture of freshwater and saltwater.

California Endangered Species Act: The California Endangered Species Act of 1985 (CESA; Fish and Game Code § 2050 *et seq.*) is implemented by the California Department of Fish and Wildlife (CDFW). CESA prohibits the "take" of listed threatened and endangered species. Take under CESA is restricted to the direct killing of a listed species and does not prohibit indirect harm by way of habitat modification.

California Environmental Quality Act: This state environmental law requires state and local public agencies to document and consider the environmental impacts of their actions. CEQA also requires an agency to identify ways to avoid or reduce significant environmental damage and to implement those mitigation measures where feasible. In addition, it provides opportunities for public participation in the decision-making process. See Public Resources Code §§ 21001.1, 21002, 21080; *State CEQA Guidelines* (California Code of Regulations [CCR]) § 15002(c).

California Native Plant Society: This society is a non-profit organization that seeks to increase understanding of California's native flora and to preserve that flora.

Canal: This structure is an artificial channel or ditch filled with water and designed for navigation, or for irrigating, i.e., to move water from one location to another.

Candidate species: Any species being considered by the U.S. Secretary of the Interior or U.S. Secretary of Commerce for listing as an endangered or threatened species, but not yet the subject of a proposed rule (see 50 Code of Federal Regulations [CFR] 424.02), or any species accepted as a candidate species by the CDFW pursuant to Fish and Game Code § 2074.2.

Carbon dioxide: A colorless, odorless gas that occurs naturally in the earth's atmosphere; substantial quantities are also emitted into the air by fossil fuel combustion.

Carbon monoxide: A colorless, odorless gas that is generated in the urban environment, primarily by the incomplete combustion of fossil fuels in motor vehicles.

Central Valley Project: California's federally-owned and operated water project, consisting of 20 dams and reservoirs and 500 miles of canals that deliver eight million acre-feet of water each year, primarily to Central Valley farmers.

Central Valley Project Improvement Act: This federal legislation, signed into law on October 30, 1992, mandates major changes in the management of the federal Central Valley Project (CVP). The CVPIA puts fish and wildlife on an equal footing with agricultural, municipal, industrial, and hydropower users.

CEQA Lead Agency: Under CEQA, a Lead Agency is the local or state governmental agency that has the principal responsibility for carrying out or approving the proposed activity.

Channel: This feature is either a natural or artificial watercourse, with a defined bed and banks that allow continuously or periodically restricted flowing water.

Clearing: The removal of all vegetation such as trees, shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds.

Climate change: Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity.

Community: All members of a specified group of species present in a specific area at a certain time.

Compaction: This is an activity to make soil dense by mechanical action, which increases the density by reducing the voids or empty spaces in a material.

Confluence: The flowing together of two or more streams; the place of meeting of two streams.

Contaminant: Any substance or property preventing the use or reducing the usability of water for ordinary purposes such as drinking, bathing, recreation and cooling. It is generally considered synonymous with pollutant.

Contiguous: Actual contact with; also, near or adjacent to.

Contour: A line of constant elevation.

Cubic feet per second: A measurement of water flow equivalent to one cubic foot of water passing a given point in a second. One cubic foot is approximately 7.5 gallons.

Cultural resource: An aspect of a cultural system that is valued by or significantly representative of a culture or that contains substantial information about a culture. Properties such as landscapes or districts, sites, buildings, structures, objects, or cultural practices that are usually greater than 50 years of age and possess architectural, historic, scientific, or other technical value are identified as cultural resources.

Culvert: A pipe or small bridge for drainage under a highway, railroad, canal, or other embankment.

Cumulative impact: For CEQA purposes, defined as the change in the physical environment that results from the incremental impact of the project when added to other, closely related past, present and reasonably foreseeable future projects.

Dam: A barrier built across a river or stream to hold water.

Decibels: Units of measurement that express the intensity of sound; degree of loudness.

Delta: The site where the rivers empty; an outlet from land to ocean, also where the rivers deposit sediment they carry forming landforms.

Delta islands: Islands in the Sacramento-San Joaquin River Delta protected by levees. Delta Islands provide space for numerous functions including agriculture, communities, and important infrastructure such as transmission lines, pipelines, and roadways.

Delta smelt: A small, slender-bodied fish with a typical adult size of two to three inches that is found only in the Sacramento-San Joaquin River Delta estuary.

Designated critical habitat: As defined by the federal Endangered Species Act, a specific geographic area(s) containing features essential for the conservation of a threatened or endangered species and that may require special management and protection.

Dewatering: A method used to eliminate water from a lake, river, stream, reservoir, or containment that allows construction activities to proceed as intended.

Discharge: Volume of water that passes a designated point within a given period of time. Any spilling, leaking, pumping, pouring, emitting, emptying, or dumping not including permitted activities in compliance with § 402 of the federal Clean Water Act.

Dissolved organic carbon: DOC is used to describe the thousands of dissolved compounds found in water that derive from organic materials (such as decomposed plant matter).

Disturbance: A discrete event, either natural or human induced, that causes a change in the condition of an ecological system.

Dredge: To dig, gather, or remove bottom materials (e.g., soil, rocks, sediments, etc.) to deepen waterways.

Duripan: A geologic term for a horizon in mineral soil characterized by cementation by silica.

Easement: An interest in land owned by another individual or organization that entitles its holder to a specific limited use and/or access.

Ecosystem: Where living and non-living things interact (coexist) in order to survive. An ecosystem consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living or abiotic environment.

Electrical conductivity: A measure of the salt content of water.

Elevation: The height of a point above a plane of reference. Generally refers to the height above sea level.

Endangered species: Any species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that is in serious danger of becoming extinct throughout all or a significant portion of its range, in compliance with the federal Endangered Species Act (ESA). Official federal designations of endangered species are made by the USFWS or NMFS and published in the *Federal Register*. Species are also listed under CESA by the CDFW.

Environmental Impact Report: A detailed document prepared by a state or local public agency to comply with CEQA. The EIR describes and analyzes significant or potentially significant effects by a project on the physical environment and discusses actions and strategies to avoid or substantially lessen those effects.

Estuary: A body of water where fresh water meets salt water.

Evolutionarily Significant Unit: This distinction of the Pacific salmon is considered to be a distinct population segment and thus a species under the federal ESA.

Exotic species: A non-native species that is introduced into an area.

Extinct: No longer in existence; i.e., died out leaving no living representatives.

Farmland of Statewide Importance: Farmland of Statewide Importance is land other than Prime Farmland which has a good combination of physical and chemical characteristics for the production of crops. It must have been used for the production of irrigated crops at some time during the two update cycles prior to the mapping date. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.

Feasible: A term used to indicate that an alternative or mitigation measure is capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

Fill: Manmade deposits of natural soils or rock products and waste materials designed and installed in such a manner as to provide drainage, yet prevent the movement of soil particles due to flowing water. This type of soil has no value, except as bulk.

Flap gate: A gate hinged along one edge, usually either the top or bottom edge. Examples of bottom-hinged flap gates are tilting gates and fish belly gates – so called from their shape in cross section.

Flood: A flood event is a temporary rise in water levels resulting in inundation of areas not normally covered by water.

Flood bypass: A region of land or a large man-made structure that is designed to convey excess flood waters from a river or stream in order to reduce the risk of flooding on the natural river or stream near a key point of interest, such as a city. The best example in this situation is the Yolo Bypass in Yolo County.

Floodplain: Any land area susceptible to inundation by floodwaters from any source.

Flora: All plant life associated with a particular habitat.

Flow: Volume of water that passes a specific point within a given period of time.

Footprint: Area of the ground surface affected by construction activities.

Forage: Vegetation used for animal consumption.

Freshwater: Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids.

Front end loader: A tractor loader used in construction that both digs and dumps in front.

Fry: Salmon that have emerged from gravel, completed yolk absorption, remained in freshwater streams, and are less than a few months old.

Fyke trap: Long, bag-shaped fishing net held open by hoops used to catch eels. The hoops can be constructed from cane, aluminum, or fiberglass over which the netting is secured.

Gate: A movable device/watertight barrier that controls the flow in a conduit, pipe, or tunnel without obstructing any portion of the waterway (e.g., a canal or ditch) when in the fully open position.

Gauge: A device that registers water level, discharge, velocity, pressure, etc.

General plan: A planning document, usually at the city or county level that encapsulates policies for land use and development over a specified period of time. A general plan may be supplemented by specific plans that address land use and development policies for specific portions of a planning jurisdiction, such as historic districts or areas slated for redevelopment.

Generator: A machine that converts mechanical energy into electrical energy.

Geomorphology: A scientific branch of geology that studies the characteristics and configuration and evolution of rocks and land forms on the earth's surface.

Grade: The inclination or slope of a pipeline, conduit, stream channel, or natural ground surface; usually expressed in terms of the ratio or percentage of number of units of vertical rise or fall per unit of horizontal distance ("rise over run").

Gradient: General slope or rate of change in vertical elevation per unit of horizontal distance of water surface of a flowing stream. Slope along a specific route, as of a road surface, channel or pipe.

Grading: Altering a land surface by cutting, filling and/or smoothing during construction to meet a designated form and function.

Grazing land: Grazing land is defined in Government Code § 65570(b)(3) as "...land on which the existing vegetation, whether grown naturally or through management, is suitable for grazing or browsing of livestock." Grazing land does not include land previously designated as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance, and heavily brushed, timbered, excessively steep, or rocky lands, which restrict the access and movement of livestock.

Groundwater: Water that has percolated into natural, underground aquifers; water in the ground, not water that remains on the ground.

Groundwater table: The upper surface of the zone of saturation (all pores of subsoil filled with water), except where the surface is formed by an impermeable body.

Growing season: The period, often the frost-free period, during which the climate is such that crops can be produced.

Grubbing: This is the process of removing stumps, roots, and vegetable matter from the ground surface after clearing and prior to excavation.

Habitat: The location where a particular taxon of plant or animal lives and its surroundings, both living and non-living; the term includes the presence of a group of particular environmental conditions surrounding an organism including air, water, soil, mineral elements, moisture, temperature, and topography.

Habitat conservation plan: Planning document that is a mandatory component of an incidental take permit application under the federal ESA. The plan specifies, among other things, the impacts that are likely to result from take and the measures the permit applicant will undertake to minimize and mitigate such impacts.

Harass: Defined in regulations implementing the federal ESA promulgated by the Department of the Interior as “an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, and sheltering.” (50 CFR 17.3)

Harm: Defined in regulations implementing the federal ESA promulgated by the Department of the Interior as an act “which actually kills or injures” listed wildlife; harm may include “significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.” (50 CFR 17.3)

Hazardous materials: Materials that are toxic, flammable, explosive, corrosive, combinations of these, or otherwise injurious to life and health.

Herbicide: This type of compound, usually a man-made organic chemical, is used to kill or control plant growth.

Hydrology: This is the scientific study of water in nature: its properties, distribution, and behavior. It also examines the occurrence, circulation properties, and distribution of the waters of the earth and their reaction to the environment.

Important farmland: As defined by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), Important Farmlands include Prime Farmland, Unique Farmland, Farmland of Statewide Importance, and Farmland of Local Importance. The categorization of farmland is based upon a soil classification system, which accounts for the physical and chemical characteristics of the land and suitability of the land for producing crops.

Incidental take permit: Permit issued by the USFWS that authorizes the incidental take of a listed species. The permit does not authorize the activities that result in take. The permit is submitted with a habitat conservation plan.

Intermittent stream: An ephemeral stream that flows part of the time, usually after rainstorm, during wet weather, or for only part of the year.

Intertidal: The zone between high and low tide.

Inundate: To cover with impounded waters or floodwaters.

Invertebrate: Any animal that lacks a backbone or spinal column.

Irrigated acreage: This type of farmland is irrigated in any one year. It includes irrigated cropland harvested, irrigated pasture, cropland planted but not harvested, and acreage in irrigation rotation used for soil-building crops.

Irrigation: Applying water to crops, lawns or other plants using pumps, pipes, hoses, and/or sprinklers.

Jeopardy opinion: The opinion of the USFWS or NMFS that a proposed project would likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The opinion includes reasonable and prudent alternatives, if any.

Jurisdiction: Boundary of authorization for a government agency. A term used to describe the level of responsibility a public entity has for a specific geographic area using its rules and regulations.

Juvenile: An early life stage of fish older than one year but not yet capable of reproduction.

Lead: A stable element that persists and accumulates both in the physical environment and in humans and animals that can lead to toxic effects.

Levee: A natural or man-made barrier that prevents rivers from overflowing their banks.

Listed: For the purposes of this section, listed is defined as any species that is identified as candidate, threatened, or endangered pursuant to CESA and/or listed as threatened or endangered under FESA.

Macroinvertebrates: An animal without a backbone and is visible to the eye, without the aid of a microscope, such as a crayfish in the aquatic environment.

Maximum contaminant level: The highest drinking water contaminant concentration allowed under federal and state Safe Drinking Water Act regulations. This threshold is set by USEPA for a regulated substance in drinking water.

Microorganism: An animal or plant that is microscopic in size.

Mitigation: Actions taken to avoid or substantially lessen significant environmental impacts when a project is carried out. Mitigation measures shall:

1. Avoid the impact altogether by not taking a certain action or parts of an action.
2. Minimize impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectify the impact by repairing, rehabilitating, or restoring the affected environment.
4. Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.
5. Compensate for the impact by replacing or providing substitute resources or environments.

National Pollutant Discharge Elimination System: A permitting program under § 402 of the federal CWA required for all point sources discharging pollutants into waters of the United States. The purpose of the NPDES program is to protect human health and the environment.

National Register of Historic Places: A federally-maintained register of districts, sites, buildings, structures, architecture, archeology, and culture.

Natural Community Conservation Plan: A conservation plan created to meet the requirements of the California Fish and Game Code, § 2800, *et seq*.

NAVD88: North American Vertical Datum 1988. This is the vertical control datum established in 1991 by the minimum-constraint adjustment of the Canadian-Mexican-United States leveling observations. It held fixed the height of the primary tidal bench mark, referenced to the new International Great Lakes Datum of 1985 local mean sea level height value, at Father Point/Rimouski, Quebec, Canada (NGS 2014).

Nitrogen oxides: A class of pollutant compounds that include nitrogen dioxide (NO2) and nitric oxide (NO), both of which are emitted by motor vehicles.

No jeopardy opinion: The opinion of either the USFWS or NMFS that a proposed project would not likely jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat.

Nonattainment: An air basin is considered to be in nonattainment for a particular air criteria pollutant if it is exceeding federal or state standards for that pollutant.

Non-native species: Also called introduced or exotic species, these kinds of species of plants or animals originate elsewhere and are brought/arrive into a new area, where they may dominate the local species or in some way negatively impact the environment for native species.

Non-point source pollution: Pollution that is so general or covers such a wide area that no single, localized source of the pollution can be identified. These are forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land use activities, which are carried to lakes and streams by surface runoff.

Notice of Preparation: The notice issued by a CEQA Lead Agency, and to a lesser extent a CEQA Responsible Agency, to publicly announce its intention to analyze a proposed project and write an environmental impact report pursuant to CEQA.

Nutrients: Animal, vegetable, or mineral substances, which sustain individual organisms and ecosystems.

Organism: Any individual form of life, such as a plant, animal or bacterium.

Outflow: The amount of water passing a specified point downstream of a structure, expressed in acre-feet per day or cubic feet per second.

Overtopping: Flow of water over the top of a dam or embankment.

Ozone: A photochemical oxidant that is a major cause of lung and eye irritation in urban environments.

Particulate matter: Liquid and solid particles of a wide range of sizes and compositions; of particular concern for air quality are particles smaller than or equal to 10 microns and 2.5 microns (PM10 and PM2.5, respectively).

Peat: Soil formed of dead but not fully decayed plants found in bog areas.

Pelagic fish: Fishes that spend most of their lives swimming in the water column with little contact with or dependency on the bottom. Adult spawning usually occurs in open water, often near the surface.

pH: A measurement of solution acidity with a relative scale, from 0 to 14. pH indicates how acidic or basic (alkaline) a solution is, where a pH of 7 is neutral, and smaller readings become increasingly acid. Natural waters usually have a pH between 6.5 and 8.5.

Piscivorous: A carnivorous diet consisting largely of fish.

Plankton: Tiny, usually microscopic, plants (phytoplankton) and animals (zooplankton) with limited powers of locomotion, usually living free (i.e., floating) in the water away from substrates. Plankton is often a major source of nutrition for larger aquatic life forms.

Pollutant: Any inorganic or organic substance that contaminates air, water, or soil. Generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

Population: Total number of individuals occupying an area.

Porter-Cologne Water Quality Control Act: Also referred to as the ‘Porter-Cologne Act’, it is contained in the California Water Code, Division 7, § 13000 *et seq*. It is the principle law governing water quality regulation in California and directs the SWRCB to formulate and adopt state policies for controlling water quality.

Prime Farmland: Prime Farmland is land that has the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed, including water management, according to current farming methods. Prime Farmland must have been used for the production of irrigated crops at some time during the two update cycles prior to the mapping date. It does not include publicly-owned lands for which there is an adopted policy preventing agricultural use.

Pumping plant: This type of facility lifts water up and over hills.

Qualitative: Descriptive term of kind, type or direction, as opposed to size, magnitude or degree.

Quantitative: Descriptive term of having to do with quantity, and/or capable of being measured.

Range: Geographic region in which a given plant or animal normally lives or grows.

Raptor: A bird species in the order Falconiformes (such as hawks, eagles, kites, and falcons), and in the order Strigiformes (owls).

Reach: Any specified length of stream, channel, or other water course.

Rhizome: A horizontal underground stem that sends out roots and shoots from its nodes.

Right-of-way: A legal right of passage or access over a defined area of real property.

Riparian area: The land adjacent to a natural watercourse such as a river or a stream. Riparian areas support vegetation that provides important wildlife habitat, as well as important fish habitat when sufficient to overhang the bank and enter the water.

Ruderal: Weedy vegetation that is dominated by introduced species, and is characteristic of areas where native vegetation has been disturbed or removed.

Runoff: Water that travels over the surface of the Earth, moving downward due to gravity.

Sacramento-San Joaquin River Delta: The legal Bay-Delta, as described in the California Water Code § 12220, generally extends from Sacramento to the north, Tracy to the south, Interstate 5 to the east, and Collinsville to the west. The Bay-Delta covers approximately 738,000 acres.

Salinity: Generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids - TDS), electrical conductivity, or osmotic pressure. Where seawater is known to be the major source of salt, salinity is often used to refer to the concentration of chlorides in the water.

Salmonid fishes: Family of fish that includes salmon and steelhead.

Scour: Erosion in a stream bed, particularly if caused or increased by channel changes.

Sediment: Unconsolidated solid material that comes from weathering of rock and is carried by, suspended in, or deposited by water or wind.

Sediment concentration: The quantity of sediment relative to the quantity of transporting fluid, or fluid sediment moisture.

Sediment discharge: Rate at which sediment passes a stream cross-section in a given period of time, expressed in millions of tons per day.

Sediment load: Mass of sediment passing through a stream cross-section in a specified period of time, expressed in millions of tons.

Sedimentation: The phenomenon of sediment or other fine particulates entering a water body, or being disturbed from the bottom such that they move downstream and settle on the substrate in other aquatic areas.

Sequestration: CO2 sequestration is the storage of CO2 (usually captured from the atmosphere) in a solid material through biological or physical processes. Wetlands can provide carbon capture and storage.

Shallow water: Water with just enough depth to allow for sunlight penetration, plant growth, and the development of small organisms that function as fish food. Such habitats serve as spawning areas for the delta smelt.

Slope: Change in elevation per unit of horizontal distance. Also, a slope can be characterized as the inclined face of a cut, canal, or embankment.

Slough: A muddy or marshy area; a secondary channel of a river delta, usually flushed by the tide.

Smolt: A juvenile salmonid migrating to the ocean and undergoing physiological changes (called smoltification) to adapt from a freshwater to a saltwater environment.

Spawn: To lay eggs, refers mostly to fish.

Special-status species: Species that are in at least one of the following categories: listed as threatened or endangered under the federal ESA; proposed for federal listing under the ESA; federal candidates under ESA; listed as threatened or endangered under the CESA; candidates under CESA; plants listed as rare under the California Native Plant Protection Act; California fully protected species or specified birds under various sections of the California Fish and Game Code; California species of special concern; or California Native Plant Society List 1A, IB, 2, or 3 species.

Species: Basic category of biological classification for a single kind of animal or plant.

Stability: Tendency of systems, especially ecosystems, to persist, relatively unchanged, through time; also, persistence of a component of a system.

Stable: A term for not changing or fluctuating; firmly established.

Staging area: Location where construction equipment and materials may be stored prior to use.

Storm flow: Surface flow originating from precipitation and runoff, which has not percolated to an underground basin.

State Water Project: California's largest water supply project operated and maintained by the California Department of Water Resources that stores surplus water during wet periods and later distributes it to areas of need in the San Francisco Bay area, northern California, San Joaquin Valley, and Southern California. SWP facilities include 23 dams and reservoirs, 18 pumping plants, four generating-pumping plants, five hydroelectric power plants, and approximately 600 miles of canals and pipelines.

Stockpile: A storage pile of materials, such as soils.

Stormwater: Untreated surface runoff into a body of water during periods of precipitation.

Stream capacity: Total volume of water that a stream can carry within the normal high water channel.

Subsidence: A decrease in ground surface elevation in the Bay-Delta region, which results primarily from peat soil being converted into gas, wind erosion, and compaction.

Substrate: A surface on which an organism grows or is attached.

Sulfur oxides: Sulfur oxygen compounds that include the important air criteria pollutants, e.g., sulfur dioxide (SO2) and sulfur trioxide (SO3).

Surface water: An open body of water, such as a river, stream or lake, and all springs, wells, or other collectors, which are directly influenced by surface water.

Suspended: The term applies to the state of floating in water.

Swale: A low place in a tract of land, such as a wide, shallow ditch, usually grassed or paved.

Take: Defined in FESA as "…harass, harm pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" on special-status species covered under FESA or CESA.

Terrestrial species: Types of species of animals and plants that live on or grow from the land.

Threatened species: Legal status afforded to plant or animal species that are likely to become endangered within the foreseeable future throughout all or a significant portion of the range, as determined by the USFWS or NMFS for federal species and by the CDFW for state species.

Toe drain: Open-jointed tile or perforated pipe located at the toe of the dam used in conjunction with horizontal drainage blankets to collect seepage from the embankment and foundation and conveys the seepage to a location downstream from the dam.

Topographic map: A map indicating surface elevation and slope, e.g., USGS quadrangle series maps showing the shape of the earth's surface by contours. They also show control data, boundaries, roads, buildings, watercourses, lakes and reservoirs, and other land features. The 7.5-minute series is appropriate for doing inundation mapping.

Topography: Physical shape of the ground surface, especially the relief and contour of the land.

Topsoil: The topmost layer of soil, usually containing organic matter, which is capable of supporting plant growth.

Total maximum daily loads: Estimates of the amount of specific pollutants that a body of water can safely take without threatening beneficial uses.

Transmission line: Facility for transmitting electrical energy at high voltage from one point to another point. Transmission line voltages are normally 115-kilovolt or larger.

Tributary: River or stream flowing into a larger river or stream.

Trihalomethanes: Any of several synthetic organic compounds formed when chlorine or bromine combine with organic materials in water.

Trophic level: Ranking of an animal within the food chain.

Turbidity: A measure of the cloudiness of water caused by the presence of suspended matter.

Unique Farmland: Unique Farmland is land which does not meet the criteria for Prime Farmland or Farmland of Statewide Importance, that has been used for the production of specific high economic value crops at some time during the two update cycles prior to the mapping date. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality and/or high yields of a specific crop when treated and managed according to current farming methods. Examples of such crops may include oranges, olives, avocados, rice, grapes, and cut flowers. It does not include publicly-owned lands for which there is an adopted policy preventing agricultural use.

Vernal pool: Seasonally-ponded landscape depressions in which water accumulates because of limitations to subsurface drainage and that support a distinct association of plants and animals.

Volatile organic compound: A chemical compound that evaporates readily at room temperature and contains carbon.

Water column: A section of water extending from the surface of a body of water to its bottom.

Water quality: The condition of water as it relates to impurities.

Water rights: A legally protected right to take possession of water occurring in a natural waterway and to divert that water for beneficial use.

Waters of the United States: As defined in the Clean Water Act §404, waters of the U.S. applies only to surface waters, rivers, lakes, estuaries, coastal waters, and wetlands. Not all surface waters are legally waters of the United States. Generally, those waters include interstate waters and tributaries, intrastate waters and tributaries used in interstate and/or foreign commerce, territorial seas at the cyclical high-tide mark, and wetlands adjacent to the above.

Watershed: A region or area where water ultimately drains or flows to a river, stream, lake or other body of water.

Water table: The groundwater level in an unconfined aquifer.

Weir: An overflow structure built across an open channel to raise the upstream water level and/or to measure the flow of water.

Well: A hole or shaft drilled into the earth to get water or other underground substances.

Wetland: A zone that is periodically or continuously submerged or has high soil moisture, has aquatic and/or riparian vegetation components, and is maintained by water supplies significantly in excess of those otherwise available through local precipitation. Lands including swamps, marshes, bogs, and similar areas such as wet meadows, river overflows, mudflats, and ponds.

Wildlife corridor: A belt of habitat that is essentially free of physical barriers such as fences, walls, and development, and connects two or more larger areas of habitat, allowing wildlife to move between physically separate areas.

Williamson Act: The California Land Conservation Act of 1965, commonly known as the Williamson Act, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use for ten years. In return, landowners receive property tax assessments that are based on farming and open space uses as opposed to full market value.

Appendix D

List of Technical Studies

Prospect Island Alternative Screening Analysis for Primary Productivity Enhancement and Export. Resource Management Associates. 2012.

Prospect Island Phase 1 Dissolved Organic Carbon Modeling. cbec eco engineering. October 2012.

Prospect Island Phase 1 Flood Conveyance Modeling. cbec eco engineering. September 2012.

Phase 1 Alternative Screening Analysis for Prospect Island Restoration "Minimize Reduction of Tidal Range" (I-7). Resource Management Associates. August 2012.

Phase 1 Alternative Screening Analysis for Prospect Island Restoration "Minimize Velocity Cross Currents in the Sacramento Deep Water Ship Channel" (I-9). Resource Management Associates. September 2012.

Phase 1 Alternative Screening Analysis for Prospect Island Restoration "Minimize Scour Potential to Ryer Island Miner Slough Levee" (I-11). Resource Management Associates. September 2012.

Prospect Island Tidal Habitat Restoration Project Evaluation of Effects of Prospect Island Restoration on Sediment Transport and Turbidity: Phase 2 Alternatives. Delta Modeling Associates, Inc. March 2014.

Prospect Island Tidal Restoration Project Phase 2 Alternatives Modeling Evaluation for Flow and Salinity Changes. Resource Management Associates. June 2014.

Prospect Island Tidal Restoration Project Analysis of Primary Productivity Enhancement and Export for Phase 2 Alternatives Evaluation. Resource Management Associates. February 2014.

Prospect Island Tidal Restoration Project Phase 2 Alternatives Modeling Evaluation for Water Temperature Changes. Resource Management Associates. May 2014.

Prospect Island Tidal Habitat Restoration Project Overflow Weir Design. cbec eco engineering and Wetlands and Water Resources. July 2012.

Prospect Island Natural Gas Wells Evaluation of Potential Environmental Threat. California Department of Water Resources. July 2009.

Site Characterization and Groundwater Monitoring Data Collection Summary Prospect Island Tidal Habitat Restoration Project Solano County, California. California Department of Water Resources. June 2013.

Site Characterization and Groundwater Monitoring Data Analysis Summary, Prospect Island Tidal Habitat Restoration Project, Solano County, California. California Department of Water Resources. January 2014.

Preliminary Wetland Delineation for the Prospect Island Tidal Habitat Restoration Project, Solano County, California. Stillwater Sciences. 2014.

Supplemental Archaeological Survey Report Prospect Island Tidal Habitat Restoration Project, Solano County, California. California Department of Water Resources. September 2014.

Cultural Resources Inventory and Effects Assessment for the Prospect Island Project, Solano County, California. Parus Consulting, Inc. May 2012.

Shipwreck Survey of a Portion of Miner Slough for the Prospect Island Project, Solano County, California. Parus Consulting, Inc. June 2014.

Prospect Island Ecosystem Restoration Project Solano County, California Environmental Assessment/
Initial Study. US Army Corps of Engineers Sacramento District and California Department of Water Resources. June 2001.

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Appendix E

Botanical Survey Report for the Prospect Island Tidal Habitat Restoration Project

Botanical Survey Report

for the

Prospect Island Tidal Habitat Restoration Project

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INTRODUCTION

Project Location

STATE: California
COUNTY: Solano
CITY: Unincorporated
CENTER COORDINATES OF SITE: 38°16'05.58"N, 121°39'12.60"W
NAME OF NEAREST WATERBODY: Miner Slough
USGS 7.5-MINUTE QUADRANGLE: Liberty Island
TOWNSHIP, RANGE, SECTION: 5 North, 3 East, 15, 16, 21, 22, 28 and 29

The proposed Prospect Island Tidal Habitat Restoration Project is located in Solano County, in the northwestern Sacramento-San Joaquin Delta. Prospect Island lies between the Sacramento Deep Water Ship Channel on the west and Miner Slough on the east. Currently, Prospect Island is surrounded by a levee which isolates the interior of the island from tidal influence present in surrounding water ways. The island is also bisected by an east-west cross levee which hydrologically separates the northern portion of the island from the southern portion. The Department of Water Resources (DWR) owns the northern 1,300 acres and the Port of West Sacramento owns the southern 300 acres.

The Project Area includes all of Prospect Island and the surrounding levees down to Mean High High Water (MHHW) on Miner Slough and the Sacramento Deep Water Ship Channel. No activities are currently planned that will affect the Deep Water Ship Channel. Potential breach locations along Miner Slough have been delineated and include a buffer into the channel.

Project Description

The proposed project is a component of DWR's and the California Department of Fish and Wildlife's (CDFW) Fish Restoration Program Agreement. This project is intended to partially fulfill the 8,000 acre tidal habitat restoration obligations which are required to comply with the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) biological opinions and the CDFW Incidental Take Permit for the State Water Project and Delta operations.

Restoration of tidal influence to the interior of Prospect Island would include the following actions:

- Dewatering of the island interior, clearing and grubbing, construction of access ramps and roads, and staging areas to prepare the site for pre-construction;
- Invasive species control;
- Debris removal;
- Excavation of subtidal-elevation tidal sloughs and channels to facilitate tidal circulation and external connectivity;
- Placement of excavated or imported soils to fill remnant agricultural ditches and/or to create topographic variability within the site;

- Construction of a sloped toe berm on the interior side of the eastern levee to improve levee erosion protection;
- Removal of a portion of the interior cross levee to hydrologically connect the two properties and promote tidal circulation;
- Excavation/construction of one or more levee breaches and/or weirs on Miner Slough to restore tidal connectivity; and,
- Possible dredging of the spur channel between Miner Slough and the Port property for the purpose of providing unimpeded tidal exchange.

The proposed project would ultimately result in the conversion of 340 acres of non-tidal and muted-tidal wetland to tidal wetland and waters.

ENVIRONMENTAL SETTING

Regional Setting

Prospect Island is located in Solano County, in the northwestern Sacramento-San Joaquin Delta. Prospect Island is within the Sacramento River Flood Control Project levee system and is separated from the southern end of the Yolo Bypass by the Sacramento Deep Water Ship Channel. It is located just east of the naturally restored 4,500-acre Liberty Island and west of Ryer Island, which is populated and currently farmed.

The climate in this region is typically Mediterranean, with cool, wet winters and hot, dry summers, and temperatures that are somewhat moderated by onshore flows from the Pacific Ocean.

Land Cover Types

The interior of Prospect Island is currently inundated and has been mapped as non-tidal and muted-tidal wetland and open water. The northern DWR-owned portion of the island is completely cut off from tidal influence. The southern Port-owned property receives limited tidal influence through an old levee repair composed of large boulders that has degraded and currently provides a pervious obstruction to tidal exchange. The northern portion of the island is dominated by plant species such as cattails (*Typha* spp.), tules (*Schoenoplectus* spp.) and water smartweed (*Persicaria amphibia*). The southern portion of the island is largely open water early in the growing season, but is dominated by floating water primrose (*Ludwigia* sp.) by mid-summer.

A small portion of the island is elevated above current water levels and supports grassland habitat. This area was created by the spoiling of dredge materials, and is therefore not native soil. This area provides habitat for ruderal grassland species such as coyote brush (*Baccharis pilularis*) and is dominated by non-native forbs and grasses.

The island is surrounded by restricted height levees which provide appropriate elevations for valley/foothill riparian habitat. This land cover type includes waterside habitat for annual and perennial forbs such as bugleweed (*Lycopus americanus*) and common rush (*Juncus effusus*), shrubs such as

Himalayan and California blackberry (*Rubus armeniacus* and *R. ursinus*) and trees such as Goodding's black willow (*Salix gooddingii*) and Fremont's cottonwood (*Populus fremontii*).

The Proposed Project may also result in impacts to locations along tidally-influenced Miner Slough which includes the intertidal zone along the base of the levee and tidal perennial aquatic habitat within the slough and the spur channel off of Miner Slough adjacent to the southern portion of the island. This area has been known to support several special status plant species and occurrences of Suisun Marsh aster (*Symphyotrichum lentum*), Mason's lilaeopsis (*Lilaeopsis masonii*), Sanford's arrowhead (*Sagittaria sanfordii*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), and delta mudwort (*Limosella australis*) have been recorded along this channel.

Soils

The soils on the interior of the island are primarily composed of non-saline loams, and are derived from mixed alluvium and organic material (NRCS, 2014).

BOTANICAL SURVEY METHODS

Literature and Data Review

Based on reviews of the California Native Plant Society's (CNPS) Inventory of Rare, Threatened, and Endangered Plants of California for Solano County (CNPS, 2014), and searches of the USFWS Species List Generator (USFWS, 2014), and the California Natural Diversity Database (CNDDB) using Rarefind 5 (CNDDB, 2014) which were focused on the Dixon, Saxon, Clarksburg, Dozier, Liberty Island, Courtland, Birds Landing, Rio Vista, and Isleton United States Geological Survey (USGS) 7.5 Minute Quadrangles (Quads), 47 special status plant species were identified as potentially occurring in the vicinity of Prospect Island. Of these species, 32 plants were determined to have no potential to occur within the Project Area due to a lack of appropriate habitat, and four were determined to have low potential due to the low quality of the available suitable habitat. These low potential species are primarily found in valley and foothill grassland habitat, and while there is some habitat on the island which has been identified as grassland, mainly on the levees and in areas where dredge material was spoiled, the habitat is highly disturbed, dominated by non-native grasses and forbs, and is located on imported soils; therefore, grassland habitat on Prospect Island is unlikely to support grassland-adapted special status species. The remaining 11 species were identified as having moderate to high potential to occur within the Project Area, and were the focus of botanical surveys conducted in the summer of 2014. These species are listed in Table 1, below.

Table 1- Special Status Species with potential to Occur within the Project Boundary

Common Name Scientific Name	Status Federal/State/ CRPR	Blooming Period	Suitable Habitat Type	Likelihood of Occurrence in Project Area
Bristly sedge *Carex comosa*	-/-/2B.1	May-September	Coastal prairie lake margins, marshes and swamps, valley and foothill grassland	Moderate
Bolander's water hemlock *Cicuta maculata var. bolanderi*	-/-/2B.1	July-September	Coastal, fresh or brackish water marshes and swamps	Moderate
Woolly rose-mallow *Hibiscus lasiocarpos* var. *occidentalis*	-/-/1B.2	June-September	Freshwater marshes and swamps	Moderate
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	-/-/1B.2	May-July (September)	Freshwater and brackish marshes and swamps	High
Mason's lilaeopsis *Lilaeopsis masonii*	-/CR/1B.1	April-November	Brackish or freshwater marshes and swamps, and riparian scrub	High
Delta mudwort *Limosella australis*	-/-/2B.1	May-August	Usually mud banks of freshwater or brackish marshes and swamps, and riparian scrub	High
Eel-grass pondweed *Potamogeton zosteriformis*	-/-/2B.2	June-July	Assorted freshwater marshes and swamps	Moderate
Sanford's arrowhead *Sagittaria sanfordii*	-/-/1B.2	May-October	Assorted shallow freshwater marshes and swamps	High
Marsh skullcap *Scutellaria galericulata*	-/-/2B.2	June-September	Lower montane coniferous forest, mesic meadows and seeps, and marshes and swamps	Moderate
Side-flowering skullcap *Scutellaria lateriflora*	-/-/2B.2	July-September	Mesic meadows and seeps, and marshes and swamps	Moderate
Suisun Marsh aster *Symphyotrichum lentum*	-/-/1B.2	May-November	Brackish and freshwater marshes and swamps	High

Survey Planning

Life history and habitat association information for the species listed above was used to determine optimal survey timing to maximize detection potential and to focus survey effort on habitat types within the Project Boundary which are likely to support special status plant species. This information was obtained from a variety of sources, including the Jepson Manual (Baldwin, et al., 2012), the Calflora Database (Calflora, 2014) and personal knowledge of the species.

Field Investigation Methodology

Prospect Island Interior Surveys

Land-based surveys for rare plants within the Prospect Island levees were conducted on July 7th and 8th, 2014 by DWR Environmental Scientists, Lesley Hamamoto and Laura Burris. Where access to appropriate habitat was possible, meandering transects were walked to provide coverage of the survey area. Water-based surveys were conducted by airboat on September 8, 2014 by DWR Environmental Scientists, Laura Burris and Gina Radieve, with assistance from CDFW Wildlife Habitat Supervisor Curtis Hagen. The interior levee areas were surveyed visually by airboat. Binoculars were utilized to study the vegetation from approximately 10 feet from the shoreline where boat accessibility was limited. The interior water area was surveyed utilizing meandering transects where emergent vegetation and submerged snags allowed airboat access.

Surveys were floristic in nature, requiring that all plants encountered were identified to the extent necessary to determine their listing status and rarity.

Exterior Levee Surveys

Surveys for water-side plants along tidally influenced Miner Slough were conducted on August 25th and 26th, 2014 by DWR Environmental Scientists Lesley Hamamoto, Laura Burris, and Gina Radieve, with assistance from CDFW Wildlife Habitat Supervisor Curtis Hagen. The area between the levee crown and sub-tidal zone was surveyed by boat using binoculars from approximately 10 to 15 feet from the shoreline. Visibility from this distance was good, and allowed for the inspection of the entire vertical levee span. The boat was landed against the shore when closer inspection was necessary. The surveys were conducted during low tide (0.4 feet and 0.5 feet at Rio Vista) to maximize detectability of intertidal species such as Mason's lilaeopsis, delta mudwort and Sanford's arrowhead. Surveys were floristic in nature, requiring that all plants encountered were identified to the extent necessary to determine their listing status and rarity.

The waterside of the western levee which separates Prospect Island from the Sacramento Deep Water Ship Channel was not surveyed, as project activities are not currently planned for that area.

Limitations

Land-based and airboat surveys of the island interior were severely hampered by access issues, as much of the interior is overgrown by impassable vegetation including cattail, Himalayan blackberry, and willows (*Salix* spp.). Despite this limitation, much of the habitat that was determined to be most likely to support special status species was surveyed.

BOTANICAL SURVEY RESULTS

Prospect Island Interior Surveys

Land-based surveys did not detect any special status plant species within the island interior. Wetland and shallow aquatic habitats were targeted as suitable habitat for the species that have moderate to high potential to be found within the Project Area. Areas with low-growing vegetation or less densely vegetated edges were targeted for surveys. While these areas appeared to provide suitable habitat for several of the target species, no special status plants were found.

Exterior Levee Surveys

Several occurrences of special status plants, including Suisun Marsh aster, Sanford's arrowhead, Mason's lilaeopsis, delta mudwort, and Delta tule pea were recorded in the vicinity of Prospect Island (Figure 1). Waterside surveys identified 87 occurrences, comprised of approximately 287 individuals of Suisun Marsh aster, two occurrences of Mason's lilaeopsis and one Sanford's arrowhead occurrence along the Miner Slough/Prospect Island levee. Suisun Marsh aster was found growing on the levee bank within and slightly above the intertidal zone. Mason's lilaeopsis was found growing on woody debris and on an eroded bank within the intertidal zone. Sanford's arrowhead was found in a small area of mudflat along the levee bank.

As no activities are planned to take place on the Deep Water Ship Channel side of the western levee, surveys were not conducted beyond the levee crown. If project activities are later developed for this area, surveys will be needed in order to determine potential impacts to special status plants which have the potential to occur or are known to occur along the waterway.

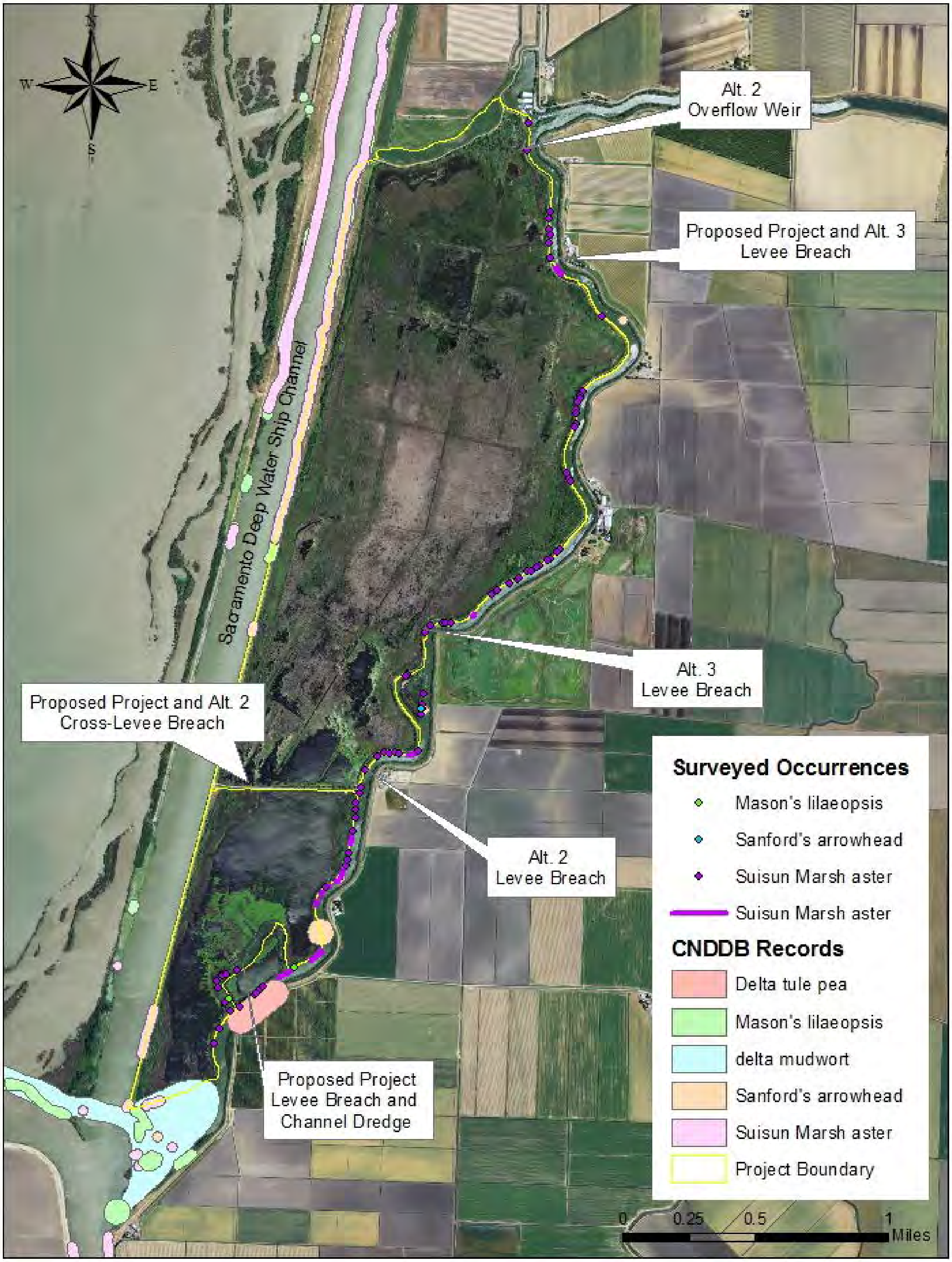

Figure 1- Confirmed and CNDDB Recorded Occurrences of Special Status Species

SUMMARY AND CONCLUSIONS

Special status plants within the Project Area were only found on the exterior of Prospect Island's eastern levee along Miner Slough. These impacts would vary depending on the breach locations and project alternative selected. Based on the existing plant occurrences, and the current project design alternatives, the Proposed Project has the potential to directly impact nine occurrences of Suisun Marsh aster and one occurrence of Mason's lilaeopsis; Alternative 2 has the potential to impact seven occurrences of Suisun Marsh aster; and Alternative 3 has the potential to impact three occurrences of Suisun Marsh aster. Additionally, special status plants in the project vicinity may potentially be impacted by invasive plant control measures which are proposed as part of the project and may include aerial herbicide application. Herbicide drift is the movement of an herbicide away from the target area, and may occur via air or water. Even low levels of herbicide drift can cause developmental and metabolic problems which may lead to reduced vigor and increased susceptibility to disease.

Mitigation measures which include conducting pre-construction surveys for special status plants to determine if individuals are located within the affected footprint, and implementation of preservation methods such as transplantation, salvage, or seed collection and dispersal if individuals will be impacted, would minimize the project's direct effects on special status plants. Indirect effects that could be caused by invasive species control methods may be limited by correct application of herbicide treatments, ensuring that products are applied according to label recommendations, and refraining from applying product under wind conditions that would increase the likelihood for drift.

The Proposed Project's goal of restoring tidal fluctuation to the interior of Prospect Island may have beneficial effects on local populations of special status plants if restoration of hydrologic connectivity provides a greater probability of colonization by water-dispersed propagules. Additionally, as many of the species seem to be preferentially or exclusively found within tidally influenced habitats, restoration of tidal fluctuation and the creation of an intertidal zone along the levee interior of the island may provide improved habitat within the island. However, suitability of this habitat is an uncertain variable, and therefore, the benefit to special status plants may be negligible.

In summary, construction impacts of the Proposed Project or Alternatives have some potential to impact special status plant species which are known to occur in the area, but mitigation measures will be implemented to decrease those impacts to less than significant levels. Restoration of tidal fluctuations within the island interior has the potential to benefit special status plants, but future habitat suitability is uncertain and benefit may be negligible.

FLORISTIC SPECIES LIST

The following table is a comprehensive phylogenetic list of all plants that were encountered and identified during the Prospect Island botanical surveys conducted during 2014.

Table 2- Floristic List of All Species Encountered During Surveys

Family	Scientific Name	Common Name
Alismataceae	*Alisma* sp.	Water-plantain
	Alisma triviale	Water-plantain
	Sagittaria sanfordii	Sanford's arrowhead
Apicaceae	*Conium maculatum*	Poison hemlock
	Foeniculum vulgare	Fennel
	Lilaeopsis masonii	Mason's lilaeopsis
	Torilis arvensis	Hedge parsley
Apocynaceae	*Apocynum cannabinum*	Indian hemp
Araceae	*Lemna* sp.	Duckweed
	Wolffia sp.	Watermeal
Araliaceae	*Hydrocotyle verticillata*	Whorled marsh pennywort
Asteraceae	*Ambrosia artemisiifolia*	Common ragweed
	Artemisia douglasiana	Mugwort
	Baccharis glutinosa	Marsh baccharis
	Baccharis pilularis	Coyote brush
	Bidens frondosa	Sticktight
	Carduus pycnocephalus	Italian thistle
	Centaurea solstitialis	Yellow star-thistle
	Cirsium occidentale	Western thistle
	Cirsium vulgare	Bull thistle
	Erigeron bonariensis	Flax-leaved horseweed
	Erigeron canadensis	Horseweed
	Euthamia occidentalis	Western goldenrod
	Helenium puberulum	Sneezeweed
	Helminthotheca echioides	Bristly ox-tongue
	Lactuca saligna	Willow lettuce
	Lactuca serriola	Prickly lettuce
	Pluchea odorata var. *odorata*	Arrow-weed
	Pseudognaphalium luteoalbum	Everlasting
	Sonchus asper	Prickly sow thistle
	Sonchus oleraceus	Common sow thistle
	Symphyotrichum lentum	Suisun Marsh aster
	Symphyotrichum subulatum ssp. *parviflorum*	Annual saltmarsh aster
	Xanthium strumarium	Cocklebur
Azollaceae	*Azolla filiculoides*	Azolla
Betulaceae	*Alnus rhombifolia*	White alder
Boraginaceae	*Heliotropium curassavicum*	Alkali heliotrope
	Myosotis laxa	Bay forget-me-not

Family	Scientific Name	Common Name
Brassicaceae	*Brassica nigra*	Black mustard
	Lepidium latifolium	Perennial pepperweed
Ceratophyllaceae	*Ceratophyllum demersum*	Hornwort
Chenopodiaceae	*Atriplex prostrata*	Fat-hen
Convolvulaceae	*Convolvulus arvensis*	Bindweed
Cornaceae	*Cornus sericea*	American dogwood
Cyperaceae	*Carex barbarae*	Santa Barbara sedge
	Cyperus eragrostis	Nutsedge
	Cyperus esculentus	Yellow nutsedge
	Schoenoplectus acutus	Common tule
	Schoenoplectus californicus	Southern bulrush
Dryopteridaceae	*Polystichum munitum*	Western sword fern
Equisetaceae	*Equisetum arvense*	Common horsetail
	Equisetum hyemale	Common scouring rush
Fabaceae	*Genista* sp.	Broom
	Glycyrrhiza lepidota	Wild licorice
	Melilotus albus	White sweetclover
	Melilotus indicus	Sourclover
	Robinia pseudoacacia	Black locust
Gentianaceae	*Centaurium tenuiflorum*	Slender centaury
Haloragaceae	*Myriophyllum aquaticum*	Parrot's feather
	Myriophyllum sp.	Water-milfoil
Juglandaceae	*Carya illinoinensis*	Pecan
	Juglans hindsii	Northern California black walnut
Juncaceae	*Juncus effusus*	Soft rush
	Typha angustifolia	Narrow-leaved cattail
	Typha domingensis	Southern cattail
	Typha latifolia	Broad-leaved cattail
Lamiaceae	*Lycopus americanus*	Bugleweed
	Mentha arvensis	Field mint
	Stachys sp.	Hedge-nettle
Lythraceae	*Lythrum salicaria*	Purple loosestrife
Malvaceae	*Abutilon theophrasti*	Velvet-leaf
	Malva parviflora	Cheeseweed
Moraceae	*Ficus carica*	Edible fig
Oleaceae	*Fraxinus latifolia*	Oregon ash
Onagraceae	*Epilobium ciliatum*	Willowherb
	Epilobium brachycarpum	Panicled willowherb
	Ludwigia peploides	Water primrose

Family	Scientific Name	Common Name
	Oenothera biennis	Common evening-primrose
Plantaginaceae	*Veronica anagallis-aquatica*	Water speedwell
Platanaceae	*Platanus racemosa*	Western sycamore
Poaceae	*Arundo donax*	Giant reed
	Cortaderia sp.	Pampas grass
	Cynodon dactylon	Bermuda grass
	Deschampsia cespitosa	Tufted hair grass
	Distichlis spicata	Salt grass
	Echinochloa crus-galli	Barnyard grass
	Elymus trachycaulus	Slender wheat grass
	Paspalum dilatatum	Dallis grass
	Phragmites australis	Common reed
	Polypogon monspeliensis	Rabbitfoot grass
	Sorghum halepense	Johnson grass
	Torreyochloa sp.?	False manna grass
Polygonaceae	*Persicaria amphibia*	Water smartweed
	Persicaria hydropiper	Waterpepper
	Persicaria hydropiperoides	False waterpepper
	Rumex crispus	Curly dock
	Rumex pulcher	Fiddle dock
Pontederiaceae	*Eichornia crassipes*	Water hyacinth
Ricciaceae	*Riccia fluitans*	Crystalwort
Rosaceae	*Potentilla rivalis*	River cinquefoil
	Potentilla sp.?	Cinquefoil
	Rosa californica	California rose
	Rubus armeniacus	Himalayan blackberry
	Rubus ursinus	California blackberry
Rubiaceae	*Cephalanthus occidentalis*	California button willow
	Galium aparine	Goose grass
Salicaceae	*Populus fremontii*	Fremont cottonwood
	Salix babylonica	Weeping willow
	Salix exigua	Sandbar willow
	Salix gooddingii	Goodding's black willow
	Salix lasiolepis	Arroyo willow
Sapindaceae	*Acer negundo*	Box elder
Solanaceae	*Solanum nigrum*	Black nightshade
Tamaricaceae	*Tamarix parviflora*	Smallflower tamarisk
Urticaceae	*Boehmeria cylindrica*	False nettle
	Urtica dioica	Stinging nettle
Verbenaceae	*Verbena bonariensis*	Purpletop vervain

Family	Scientific Name	Common Name
	Verbena hastata	Swamp verbena
Viscaceae	*Phoradendron sp.*	Mistletoe
Vitaceae	*Vitis californica*	California wild grape
Woodsiaceae	*Athyrium filix-femina*	Lady fern

REFERENCES

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, editors. 2012. The Jepson manual: vascular plants of California, second edition. University of California Press, Berkeley.

Calflora: Information on California plants for education, research and conservation, with data contributed by public and private institutions and individuals, including the Consortium of California Herbaria. 2014. Berkeley, California: The Calflora Database [a non-profit organization]. Website http://www.calflora.org/ [accessed 09 September 2014].

California Native Plant Society (CNPS), Rare Plant Program. 2014. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org [accessed 08 September 2014].

California Natural Diversity Database (CNDDB). 2014. Rarefind 5 (internet). California Department of Fish and Wildlife. Website https://map.dfg.ca.gov/rarefind/view/RareFind.aspx [accessed 08 September 2014].

Natural Resources Conservation Services (NRCS), Web Soil Survey. 2014. Custom Soil Resource Report for Solano County, California (online edition). United States Department of Agriculture Natural Resources Conservation Service. Website http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx [accessed 08 September 2014].

United States Fish and Wildlife Service (USFWS). 2014. Species List Generator (online edition). United States Department of the Interior, Sacramento Fish and Wildlife Office. Website http://www.fws.gov/sacramento/es_species/Lists/es_species_lists-form.cfm [accessed 08 September 2014].

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Appendix F

Biological Surveys

A.1 Survey

In 2014, the California Department of Water Resources (CDWR) staff conducted bird surveys to describe the avian community using the Prospect Island Tidal Habitat Restoration Project site (Project site). Several survey methods were used to census the diverse taxa represented at the Project site. This report presents the survey methods and results of the avian surveys conducted at the Project site in 2014.

A.1.1 Methods

Area survey

Surveyors conducted surveys using binoculars from vehicles and on foot throughout the Project site monthly during March through June 2014 (Figure F-1). All bird species encountered were recorded, including habitat, location, and behavior.

Point count survey

Fixed-radius point count surveys were conducted at 11 locations at the Project site in May 2014 (Ralph et al. 1995; Figure F-1). All bird species identified by sight or sound were recorded, including estimated distance away from the survey station.

Black Rail survey

Black Rail surveys were conducted from fixed points following standard call-response survey methods during March through June 2014 (Evens et al. 1991, Conway 2009; Figure F-1). Surveyors played a recording that included one minute of passive listening, one minute of recorded Black Rail calls (ki-ki-do and grr), followed by four minutes of passive listening. All wading bird responses (American Bittern, Sora, Virginia Rail, Black Rail) were recorded with approximate location.

Swainson's Hawk and nesting raptor survey

Surveyors conducted surveys for Swainson's Hawk and other raptors using binoculars and spotting scopes during March through June 2014 following the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (SWHA-TAC 2000; Figure F-1). All Swainson's Hawks encountered were recorded, including location and behavior. Known or potential nests of all raptors were recorded using GPS.

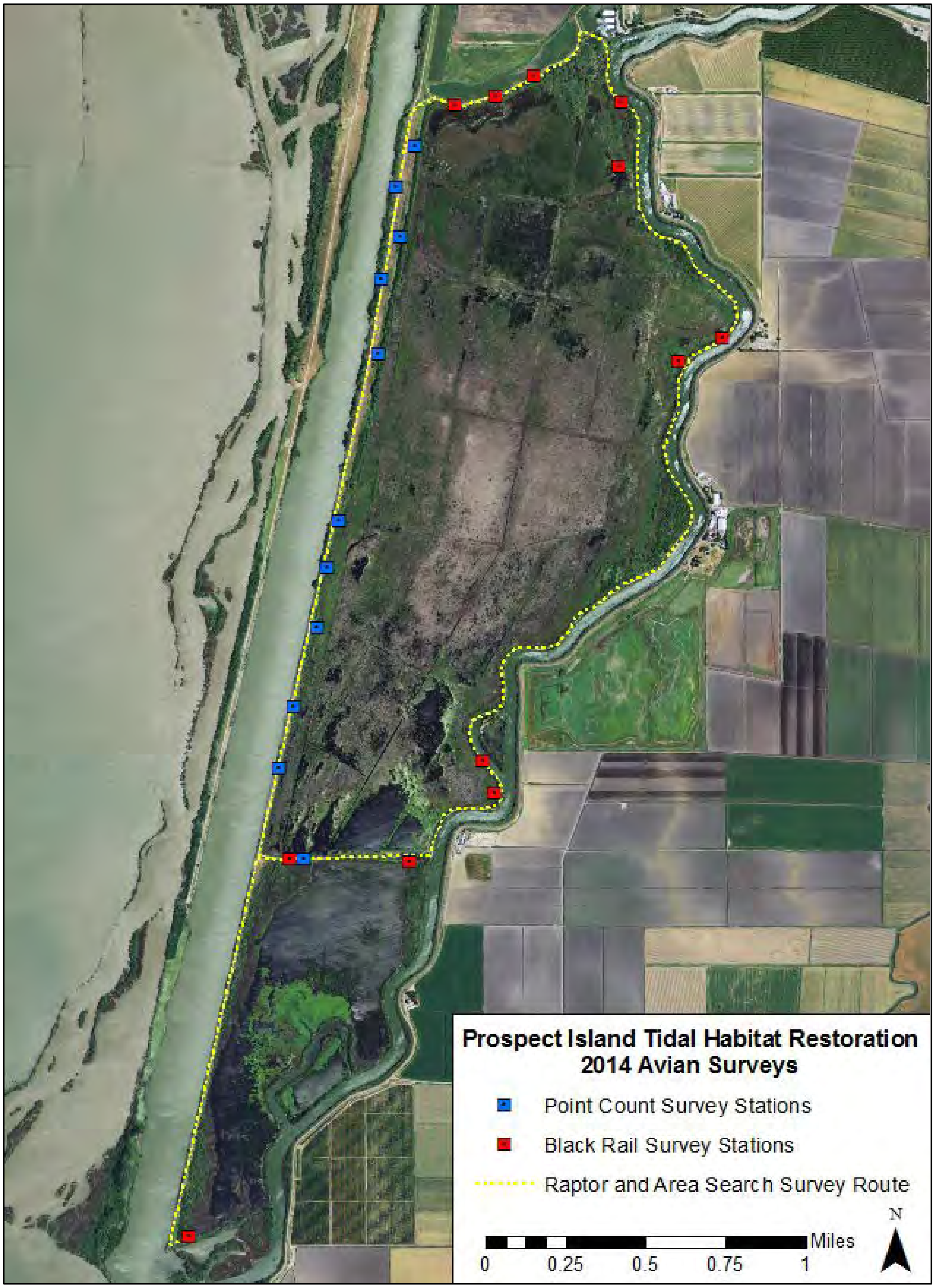


Figure F-1. Map of survey station locations and routes for 2014 avian surveys for the Prospect Island Tidal Habitat Restoration Project site.

A.1.2 Results

Area and Point Count Surveys

Surveyors encountered 87 bird species (Table F-1) at the Project site in 2014. Results of the area search and point count surveys conducted in 2014 are summarized below.

Waterfowl

Three species of waterfowl were observed using the Project site's perennial aquatic habitats and edges of perennial emergent wetland and upland habitats during 2014 surveys. Mallard and Canada Goose likely nested at the site and may reside year-round; Greater White-fronted Goose was present during migration and may overwinter. Surveys were not conducted during winter when migratory waterfowl are present in the region; it is likely other species use the Project site during winter, especially given its position on the Pacific Flyway and proximity to Yolo Bypass Wildlife Area, which contains large areas managed for waterfowl habitat.

Upland game birds

California Quail, Ring-necked Pheasant, and Wild Turkey were observed using valley/foothill riparian and upland habitats at the Project site during 2014 surveys. These species likely reside year-round at the Project site.

Waterbirds

Eighteen species of waterbirds (grebes, cormorants, herons and egrets, pelicans, shorebirds, and rails) were observed using the Project site's perennial aquatic and perennial emergent wetland habitats during 2014 surveys. American Bittern, Sora, Virginia Rail, American Coot, Common Moorhen, and Pied-billed Grebe are likely year-round residents that nested at the Project site. Double-crested Cormorant and American White Pelican were observed foraging in perennial aquatic habitats. Great Blue Heron, Great Egret, Green Heron, and Snowy Egret were observed foraging at the edges of perennial aquatic and freshwater emergent wetland habitats at the Project site; suitable nesting habitat for cormorants and herons is present in valley/foothill riparian habitats but no nesting colonies were observed. White-faced Ibis, American Avocet, and Black-necked Stilt are migratory waterbirds were observed foraging at the Project site during migration and nesting season.

Woodpeckers, doves, songbirds

Several songbird species were observed using all habitats at the Project site during 2014 surveys. Species such as Song Sparrow, Red-winged Blackbird, Common Yellowthroat, and Marsh Wren are resident birds that were abundant in perennial emergent wetland habitats. Neotropical migrants Western Kingbird, Yellow-breasted Chat, Black-headed Grosbeak, and Ash-throated Flycatcher used valley foothill riparian habitats during migration and nesting season. Resident birds such as Nuttall's Woodpecker, Western Scrub Jay, Bewick's Wren, and Bushtit also used valley foothill riparian habitats. Northern Mockingbird, American Goldfinch, Loggerhead Shrike, and Western Meadowlark used upland habitats. Invasive species such as Eurasian Collared Dove, Brown-headed Cowbird, European Starling, and Great Tailed Grackle were observed using valley foothill riparian, upland, and the fringes of perennial emergent marsh and perennial aquatic habitats.

Black Rail survey

No Black Rails were detected during standard call-response surveys conducted during 2014. Three other waterbird species responded to calls: American Bittern, Sora, and Virginia Rail. These species were observed calling from perennial emergent wetland habitats on the North and South properties (Figure F-2). Rails and bitterns are highly secretive and territorial species, and are difficult to detect. All responses were heard near survey stations; it is likely that rails and bitterns are distributed throughout marsh habitat at the Project site with suitable cover and water depths on both properties.

Swainson's Hawk and nesting raptor survey

Three Swainson's Hawks were observed using valley foothill riparian habitats at the Project site's North property (Figure F-2). Two nests were observed, and the third Swainson's Hawk was observed perching on adjacent trees on two survey dates, thus was likely nesting at the Project site. Marginal foraging habitat for Swainson's Hawk exists in upland and perennial emergent wetland habitats.

One Northern Harrier pair was observed and likely nested in perennial emergent wetland habitat on the North property (Figure F-2). The pair was also observed foraging in upland habitat on the western edge of the Site.
One Great Horned Owl was observed and likely nested in valley foothill riparian habitat in between the North and South properties.

Turkey Vulture, Red-tailed Hawk, Cooper's Hawk, and American Kestrel were also observed using the Project site during the nesting season, but no nests were observed.

Table F-1. Bird species observed using the Project site during 2014 surveys for the Prospect Island Tidal Habitat Restoration Project. Common name, scientific name, State or federal status, habitat, and seasonal use of the Project site are listed.

Common Name	Scientific Name	Status[1]	Habitat[2]	Use of Project site[3]
Greater White-fronted Goose	*Anser albifrons*		NPA, TPA	W, M; F
Canada Goose	*Branta canadensis*		NPA, TPA, U	R; N
Mallard	*Anas platyrhynchos*		NPA, TPA, U	R; N
California Quail	*Callipepla californica*		U, VFR	R; N
Ring-necked Pheasant	*Phasianus colchicus*		U, VFR	R; N
Wild Turkey	*Meleagris gallopavo*		U, VFR	R; N
Pied-billed Grebe	*Podilymbus podiceps*		NPA, TPA, NPE, TPE	R; N
Double-crested Cormorant	*Phalacrocorax auritus*		NPA, TPA	R; F
American White Pelican	*Pelecanus erythrorhynchos*	SSC	NPA, TPA	R; F
American Bittern	*Botaurus lentiginosus*		NPE, TPE	R; N
Great Blue Heron	*Ardea herodias*		NPA, TPA, NPE, TPE, U	R; F
Great Egret	*Ardea alba*		NPA, TPA, NPE, TPE, U	R; F
Snowy Egret	*Egretta thula*		NPA, TPA, NPE, TPE, U	R; F
Green Heron	*Butorides virescens*		NPA, TPA, NPE, TPE, U	R; F
Black-crowned Night-Heron	*Nycticorax nycticorax*		NPA, TPA, NPE, TPE, U	R; F
White-faced Ibis	*Plegadis chihi*		NPA, TPA, NPE, TPE	R; F
Turkey Vulture	*Cathartes aura*		VFR	R; F
Northern Harrier	*Circus cyaneus*	SSC	NPE, TPE, U	R; N
Cooper's Hawk	*Accipiter cooperii*		VFR	R; N
Swainson's Hawk	*Buteo swainsoni*	ST	VFR, U	M, N
Red-tailed Hawk	*Buteo jamaicensis*		VFR, U	R; N
American Kestrel	*Falco sparverius*		U, VFR	R; N
Virginia Rail	*Rallus limicola*		NPE, TPE	R; N
Sora	*Porzana carolina*		NPE, TPE	R; N
Common Moorhen	*Gallinula chloropus*		NPA, TPA, NPE, TPE	R; N
American Coot	*Fulica americana*		NPA, TPA, NPE, TPE	R; N
Black-necked Stilt	*Himantopus mexicanus*		NPA, TPA, NPE, TPE	S, M; N
American Avocet	*Recurvirostra americana*		NPA, TPA, NPE, TPE	S, M; N
Killdeer	*Charadrius vociferus*		NPA, TPA, NPE, TPE, U	R; N

Common Name	Scientific Name	Status[1]	Habitat[2]	Use of Project site[3]
Greater Yellowlegs	*Tringa melanoleuca*		NPA, TPA, NPE, TPE	W; F
Eurasian Collared-Dove	*Streptopelia decaocto*	Invasive	VFR, U	R; N
Mourning Dove	*Zenaida macroura*		VFR, U	R; N
Great Horned Owl	*Bubo virginianus*		VFR	R; N
White-throated Swift	*Aeronautes saxatalis*		VFR, NPE, TPE, NPA, TPA	S, M; F
Anna's Hummingbird	*Calypte anna*		U, VFR	R; N
Belted Kingfisher	*Megaceryle alcyon*		VFR, NPA, TPA	R; F
Acorn Woodpecker	*Melanerpes formicivorus*		VFR	R; N
Nuttall's Woodpecker	*Picoides nuttallii*		VFR	R; N
Downy Woodpecker	*Picoides pubescens*		VFR	R; N
Northern Flicker	*Colaptes auratus*		VFR	R; N
Black Phoebe	*Sayornis nigricans*		VFR, U, NPE, TPE	R; N
Ash-throated Flycatcher	*Myiarchus cinerascens*		VFR	S, M; N
Western Kingbird	*Tyrannus verticalis*		VFR, U	S, M; N
Loggerhead Shrike	*Lanius ludovicianus*	SSC	U, VFR	W; F
Warbling Vireo	*Vireo gilvus*		VFR	M; F
Western Scrub-Jay	*Aphelocoma californica*		U, VFR	R; N
American Crow	*Corvus brachyrhynchos*		VFR, U	R; N
Common Raven	*Corvus corax*		VFR, U	R; N
Horned Lark	*Eremophila alpestris*		U	W; F
Tree Swallow	*Tachycineta bicolor*		VFR, U, NPE, TPE, NPA, TPA	R; N
Cliff Swallow	*Petrochelidon pyrrhonota*		U, NPE, TPE, NPA, TPA	R; N
Barn Swallow	*Hirundo rustica*		U, NPE, TPE, NPA, TPA	R; N
Bushtit	*Psaltriparus minimus*		VFR, U	R; N
Marsh Wren	*Cistothorus palustris*		NPE, TPE	R; N
Bewick's Wren	*Thryomanes bewickii*		VFR	R; N
House Wren	*Troglodytes aedon*		VFR	R; N
Wrentit	*Chamaea fasciata*		VFR	R; N
American Robin	*Turdus migratorius*		VFR, U	R; N
Northern Mockingbird	*Mimus polyglottos*		U, VFR	R; N
European Starling	*Sturnus vulgaris*	Invasive	VFR, U	R; N
American Pipit	*Anthus rubescens*		U	W; F

Common Name	Scientific Name	Status[1]	Habitat[2]	Use of Project site[3]
Cedar Waxwing	*Bombycilla cedrorum*		VFR, U	W, M; F
Orange-crowned Warbler	*Oreothlypis celata*		VFR	W, M; F
Common Yellowthroat	*Geothlypis trichas*		NPE, TPE	R; N
Yellow-rumped Warbler	*Setophaga coronata*		VFR	W, M; F
Wilson's Warbler	*Cardellina pusilla*		VFR	M; F
Yellow-breasted Chat	*Icteria virens*	SSC	VFR	S, M; N
Spotted Towhee	*Pipilo maculatus*		VFR, U	R; N
California Towhee	*Melozone crissalis*		VFR, U	R; N
Savannah Sparrow	*Passerculus sandwichensis*		U	R; N
Song Sparrow	*Melospiza melodia*	SSC	NPE, TPE	R; N
Lincoln's Sparrow	*Melospiza lincolnii*		U	W, M; F
White-crowned Sparrow	*Zonotrichia leucophrys*		U, VFR	W, M; F
Golden-crowned Sparrow	*Zonotrichia atricapilla*		U, VFR	W, M; F
Dark-eyed Junco	*Junco hyemalis*		U, VFR	W, M; F
Black-headed Grosbeak	*Pheucticus melanocephalus*		VFR	S, M; N
Blue Grosbeak	*Passerina caerulea*		VFR	S, M; N
Lazuli Bunting	*Passerina amoena*		VFR	S, M; N
Red-winged Blackbird	*Agelaius phoeniceus*		NPE, TPE, U	R; N
Western Meadowlark	*Sturnella neglecta*		U	R; N
Brewer's Blackbird	*Euphagus cyanocephalus*		U, TPE, NPE	R; N
Great-tailed Grackle	*Quiscalus mexicanus*	Invasive	U, VFR, TPE, NPE	R; N
Brown-headed Cowbird	*Molothrus ater*	Invasive	VFR, U, TPE, NPE	R; N
Bullock's Oriole	*Icterus bullockii*		VFR	S, M; N
House Finch	*Haemorhous mexicanus*		VFR, U	R; N
Lesser Goldfinch	*Spinus psaltria*		U, VFR	R; N
American Goldfinch	*Spinus tristis*		U, VFR	R; N

1 Status: ST = State Threatened; SSC = California Species of Special Concern; Invasive = non-native, invasive species.

2 Habitat: NPE = nontidal freshwater perennial emergent wetland; NPA = non-tidal perennial aquatic; TPE = tidal perennial emergent wetland; TPA = tidal perennial aquatic; VFR = valley foothill riparian; U = upland.

3 Use of Project site: Time of year: R = resident year-round, M = migration, W = winter, S = summer; Activity: N = nesting, F = foraging.

Figure F-2. Locations of Swainson's Hawks, other raptors, and secretive marsh birds detected during 2014 surveys at the Prospect Island Tidal Habitat Restoration Project site.

A.2 Literature Cited

Conway, C. J. 2009. Standardized North American Marsh Bird Monitoring Protocols, version 2009-2. Wildlife Research Report #2009-02. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

Evens, J., G. W. Page, S. A. Laymon, and R. W. Stallcup. 1991. Distribution, relative abundance, and status of the California Black Rail in western North America. Condor 93: 952-966.

Ralph, C.J., S. Droege and J.R. Sauer. 1995. Managing and Monitoring Birds Using Point Counts: Standards and Applications. Pages 161-168 in C. J. Ralph, J. R. Sauer, and S. Droege, Eds. Monitoring Bird Populations by Point Counts, USDA Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-149.

SWHA-TAC (Swainson’s Hawk Technical Advisory Committee) 2000. Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. <https://www.dfg.ca.gov/wildlife/nongame/survey_monitor.html>. 5 pp.

Appendix G

Prospect Island Restoration Project
Air Quality Calculations

This Appendix contains the assumptions, methodology, data, and results of calculations used to estimate the air emissions associated with the construction of the Prospect Island Tidal Habitat Restoration Project. Criteria air pollutant emissions inventories are computed, and the results are then compared with the corresponding Yolo-Solano Air Quality Management District (YSAQMD) thresholds to make the significance determination of the air quality impact of the Project. Since the Project does not involve long-term operations and therefore would not generate air pollutant emissions, this appendix focuses on the emissions generated during the Project's three-year construction phase.

This assessment estimated the emissions of the following criteria pollutants:

- Carbon monoxide (CO),
- Reactive organic gases (ROG),
- Nitrogen oxides (NOx),
- Particulate matter measuring 10 micrometers or less in diameter (PM_{10}), and
- Particulate matter measuring 2.5 micrometers or less in diameter ($PM_{2.5}$)

In addition, the CO_2 emissions are also included.

The Proposed Project is a multi-year project which is planned to be carried out from April 2018 through the end of 2020. Attachment 1 contains the datasheets for the calculation of project emissions during the 2.5 year construction period. The calculations are based on the Project construction information in the "Greenhouse Gas Calculation" datasheets prepared by the Design Engineers. According to the "Greenhouse Gas Calculation" datasheet, the construction of the Project is made up of 27 tasks (or construction activities) as shown in Table 1-A "Construction Tasks" of Attachment 1, and each task involves working on certain project features. Table 1-B "Estimated Construction Implementation Timing" of Attachment 1 lists the construction time frame of these tasks. Table 2 "Timing, Equipment and Other Details of Construction Tasks" of Attachment 1 not only enumerates the number of pieces of each type of equipment and the total operation hours required to complete that task, but also provides the size of soil disturbance from activities such as clearing and grubbing, soil excavation and site grading. The Project would use off-road construction equipment such as dozers, excavators, and cranes for activities such as clearing and grubbing, excavation, transportation and grading of soil, and on-road vehicles such as cars for cars for worker commute, water trucks, service trucks, and trucks for material delivery on public roads. In addition, a helicopter would be used for spraying herbicide for aquatic species control. Tables 3-A "Construction Equipment

Descriptions" of Attachment 1 contains the list of construction equipment and the estimated horsepower values, and Table 3-B of Attachment 1 contains the information on the mobilization and demobilization of the construction equipment. The Project also involves importing various types of construction materials from off-site locations, and the Engineers proposed two delivery methods for importing rip-rap, fill and aggregate base materials from a near-by quarry: Option A is using barges driven by tug-boats and Option B is using trucks only. Table 4 of Attachment 1 contains the quantities of various types of construction materials to be imported and the two delivery options.

Air pollutant emissions from the Project construction come from these different types of sources: off-road construction equipment (construction vehicles and other diesel powered equipment such as generators), on-road vehicles (worker commute trips, haul truck trips for importing construction materials and exporting construction waste), helicopter for aerial herbicide spraying, barge/tug boats for material delivery, and fugitive dust from soil disturbance.

The emissions of the pollutants were estimated with the help of the Road Construction Emissions Model (the Roadway Model) version 7.1.5.1. The Roadway Model is developed by the Sacramento Metropolitan Air Quality Management District to perform quantitative air quality analysis for roadway projects, which uses off-road construction equipment and on-road vehicles for work commute and material hauling. The Roadway Model quantifies project construction emissions from the following sources: worker commute, material hauling, water truck, and fugitive dust and off-road equipment. The Roadway Model contains a pre-defined set of commonly-used off-road construction vehicles with their emission rates calculated based on the input construction year and the corresponding emission factors, default horsepower values and load factors from the California Air Resources Board's (CARB) OFFROAD2007 emission model. The Roadway Model also embeds the emission rates for on-road vehicles from CARB's EMFAC2011 emission model. However, the Roadway Model does not contain emission information on either the helicopter for aerial spraying or barges and tug boats for material delivery. The emission rates of these two types of equipment have to be obtained from separate sources. In addition, the Roadway Model is designed to calculate emissions from the construction of typical roadway projects which normally contain the following four phases: Grubbing /Land Clearing, Grading /Excavation, Draining/Utilities/ Sub-Grade, and Paving. The Proposed Project, which consists of 27 tasks, cannot fit into the Roadway Model; therefore, the Roadway Model cannot be used directly calculate the emissions from the Proposed Project.

On the other hand, the Roadway Model embeds CARB's OFFROAD2007 model for off-road equipment and EMFAC2011 model for on-road vehicles, so it can be used to calculate the emission rates in masses of emissions per hour for the list of off-road construction equipment and emission rates in masses of emissions per Vehicle-Mile-Travelled (VMT) for on-road vehicles for each of the construction years. It also carries the emission rates of fugitive dust from soil disturbance activities in California.

Several Roadway Model projects (see Attachment 2) have been created to calculate emission rates of different types of emission sources for the years of 2018, 2019 and 2020.

Table 5-A of Attachment 1 contains the unit Hourly Emissions of Off-Road Construction Equipment calculated by using the Road Model. The results were obtained by creating a Roadway Model project with the following data entry: on the "Data Entry" sheet, set the Construction Start Year field to 2018, the Project Construction Time field to 48 months, the Construction Period Fields for each phase to 12 month (so the four phases of the project correspond to the years of 2018, 2019, 2020, and 2021). In the Equipment Section, override the horsepower fields by the values provided by Design Engineers, override the Number of Construction Vehicle with 1 and set the Hours per Day field to 1. The Roadway Model would automatically calculate the emissions of pollutants ROG, NOx, CO, PM_{10}, $PM_{2.5}$ andCO_2 from Off-Road Equipment for each phase. The Off-Road Equipment Emissions section for the "Grubbing/Land Clearing" phase (the first phase) contains the emission rates (in pounds per hour) for one piece of each type of the construction equipment for the year 2018, the section for the "Grading /Excavation" phase (the second phase) contains the emission rates for the year 2019, the section for the "Draining/Utilities/ Sub-Grade" phase (the third phase) contains the emission rates for the year 2020, and so on.

Table 5-B of Attachment 1 contains the unit Hourly Emissions for Pickups, Water Trucks, and Service Trucks. The results were obtained similarly with the following inputs to the Roadway Model project: set the Construction Start Year field to 2018, the Project Construction Time field to 48 months, the Construction Period Fields for each phase to 12 month. Enter the estimated miles travelled in one hour of a typical workday in the Worker Commute section for light-duty trucks and enter the vehicle miles travelled in one hour of a typical workday in the water truck section for heavy-duty trucks. For example, assume a water truck would travel 80 miles on an 8-hour workday, it would travel 10 miles in one hour of

operation, so enter 10 miles in the water truck section. The model would automatically calculate the hourly emissions of ROG, NOx, CO, PM_{10}, $PM_{2.5}$ and CO_2 for one piece of these on-road vehicles.

Table 5-C of Attachment 1 contains the unit daily emissions for Worker Commute. The results were obtained similarly with the following inputs to the Roadway Model project: set the Construction Start Year field to 2018, the Project Construction Time field to 48 months, the Construction Period Fields for each phase to 12 month. Enter the miles of work commute trips (30 miles per trip) and 2 one-way trips per day for each worker. The model would automatically calculate the emissions of ROG, NOx, CO, PM_{10}, $PM_{2.5}$ and CO_2 for one worker per day.

Table 5-D of Attachment 1 contains the Daily fugitive dust in forms of Particular Matter from one acre of land disturbance. The emission rates are copied from the Fugitive Dust section of the Roadway Model.

Table 5-E of Attachment 1 contains the emission rates in pounds per hour for a helicopter for herbicide spraying. The emission factors, loader factors and other assumptions are presented in detail in Attachment 4.

Table 5-F of Attachment 1 contains the emission rates in pounds per hour for barges for material delivery. The emission factors, loader factors and other assumptions are presented in detail in Attachment 3.

Table 5-H of Attachment 1 contains the emission rates in grams per mile for the years 2018 through 2020 for heavy On-Road trucks. These emission rates are also obtained in the Roadway Model.

With the emission rates for all types of emission sources ready, the emissions for each task can be calculated using one of the methods described below:

Emissions of off-road equipment, helicopter, and barges and tugboats can be calculated using the formula below.

Daily Emissions (masses per day)
= Emissions Rate (in masses per hour) x Number of Pieces of Equipment x Operation Hours per Day (default 8 hours per day)

Emissions (quantity in mass)
= Emissions Rate (in masses per hour) x Total Operation Hours

Emissions for Pickups, Water Trucks, or Service Trucks can be calculated using the formula

Daily Emissions (masses per day)
= Emissions Rate (in masses per hour) x Number of Vehicles x Operation Hours per Day (default 8 hours per day)

Emissions (quantity in mass)
= Emissions Rate (in masses per hour) x Total Operation Hours

Work Commute emission can be calculated using the formula

Daily Emissions (masses per day)
= Emissions Rate (in masses per worker per day) x Number of Workers

Emissions (quantity in mass)
= Emissions Rate (in masses per worker per day) x Total Worker-Days

Emissions of on-road vehicles for material and equipment delivery can be calculated using the formula

Daily Emissions (masses per day)
= Emissions Rate (in masses per VMT) x Maximum VMT on one day

Emissions (quantity in mass)
= Emissions Rate (in masses per VMT) x Total Operation VMT

Fugitive dust emissions from soil disturbance activities can be calculated using the formula

Daily Emissions (masses per day)
= Emissions Rate (in masses per acre of soil disturbed) x Maximum Daily Acres Disturbed

Emissions (quantity in mass)
= Emissions Rate (in masses per acre of soil disturbed) x Average Daily Acres Disturbed x Number of Days of Soil Disturbance Operation

The total emissions and daily emissions from material deliveries for each task are calculated in Tables 6s and Tables 7s of Attachment 1. The PM emissions from soil disturbance activities are shown in Table 8 of Attachment 1. The calculations of the emissions generated by each construction task from on-road vehicles, off-road equipment, helicopter, and work commute are shown in Table 9-01 through 9-27. The total emissions for a task can be obtained by summing up the emissions from all emissions sources associated to that task (Tables 6s through 9s of Attachment 1).

The total emissions for each construction year of 2018, 2019 and 2020 can be calculated with emissions of the 27 tasks and the construction timing information in Table 1 of Attachment 1. The emissions in one construction year are obtained by summing up the emissions from all the tasks that are carried out in that year. Notice that the time windows of a few tasks span two years, so the emissions of these tasks would be allocated to the years proportional to the number of workdays in each year. For example, if a task would take 10-workdays with 3 workdays in year 1 and 7 workdays in year 2, 30 percent of the emissions would be in year 1 and 70 percent in year 2. The Project emissions in the years of 2018, 2019 and 2020 were calculated this way. The calculation procedures for Option A are shown in Tables 10-A and 10 and those for Option B are shown in Tables 11-A and 11-B of Attachment 1.

The results of annual emissions are summarized in Table 1 below.

Table 1. Annual Project Construction Emissions

Option A: Material Delivery Using Barges						
Pollutants	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2
2018 Emissions (tons)	1.2	6.5	13.2	2.1	0.8	1888.7
2019 Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
2020 Emissions (tons)	0.5	3.6	5.0	0.5	0.2	962.5
Maximum Annual Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
Total Project Emissions (tons)	3.8	25.0	39.1	4.7	2.1	6384.8
Option B: Material Delivery Using Trucks						
2018 Emissions (tons)	0.8	4.3	8.1	1.9	0.6	1337.1
2019 Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
2020 Emissions (tons)	0.5	3.4	4.6	0.5	0.2	917.2
Maximum Annual Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
Total Project Emissions (tons)	3.3	22.7	33.6	4.6	1.9	5788.0

Similarly the maximum daily emissions for a task can be obtained by combining the daily emissions of all emission sources of the task. This approach calculates the worst case scenario by assuming all construction equipment would be in operation on the same day, so the results would be very conservative. In addition, Table 1 of Attachment 1 identifies all possible sets of tasks whose time windows would overlap. The maximum daily emissions in a time period covered by multiple tasks can be obtained by combing the maximum daily emissions of the involved tasks. The maximum daily emissions for the whole project can be obtained by taking the maximum value from the maximum daily emission values of all 27 tasks and the maximum daily emissions of the overlapping tasks. The calculation procedures for the maximum daily emissions for Option A are shown in Tables 10-A and 10-B and those for Option B are shown in Tables 11-A and 11-B of Attachment 1. The Maximum Daily Construction Emissions are summarized in Table 2.

Table 2. Maximum Daily Construction Emissions

Option A: Material Delivery Using Barges						
Pollutants	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO_2
Maximum Daily Emissions (pounds)	87.5	289.4	525.2	78.5	29.6	84,083
Option B: Material Delivery Using Trucks						
Maximum Daily Emissions (pounds)	76.5	229.2	429.6	74.4	24.3	90,187

The Project's annual and daily construction emissions, the corresponding YSAQMD threshold values and the resulting CEQA determination are summarized in Table 3.

Table 3. Construction Emission Summary and YSAQMD Threshold Values

	Pollutants	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**CO2**
Option A: Material Delivery Using Barges	2018 Emissions (tons)	1.2	6.5	**13.2**	2.1	0.8	1,889
	2019 Emissions (tons)	2.1	15.0	**20.9**	2.2	1.0	3,534
	2020 Emissions (tons)	0.5	3.6	5.0	0.5	0.2	963
	Maximum Annual Emissions (tons)	2.1	15.0	**20.9**	2.2	1.0	3,534
	Total Project Emissions (tons)	3.8	25.0	39.1	4.7	2.1	6,385
	YSAQMD Significance Threshold (tons)	**10**		**10**			
	Significance Determination	No		**Yes**			
	Maximum Daily Emissions (pounds/day)	87.5	289.4	525.2	78.5	29.6	84,083
	YSAQMD Significance Threshold (pounds/day)				80		
	Significance Determination				No		
Option B: Material Delivery Using Trucks	2018 Emissions (tons)	0.8	4.3	8.1	1.9	0.6	1,337
	2019 Emissions (tons)	2.1	15.0	**20.9**	2.2	1.0	3,534
	2020 Emissions (tons)	0.5	3.4	4.6	0.5	0.2	917.2
	Maximum Annual Emissions (tons)	2.1	15.0	**20.9**	2.2	1.0	3,534
	Total Project Emissions (tons)	3.3	22.7	33.6	4.6	1.9	5,788
	YSAQMD Significance Threshold (tons)	**10**		**10**			
	YSAQMD Significance Threshold (tons)	No		**Yes**			
	Maximum Daily Emissions (pounds/day)	76.5	229.2	429.6	74.4	24.3	90,187
	YSAQMD Significance Threshold (pounds/day)				**80**		
	Significance Determination				No		

Table 3 indicates that both options would have significant impacts in terms of annual NOx emissions, while the annual ROG emissions and maximum daily PM10 emissions would not exceed the threshold value and would have less than significant impacts. In addition, the annual NOx emissions are more than twice of the YSAQMD emission threshold value. Table 3 also shows that the Option A would generate more emissions than Option B.

Attachment 1

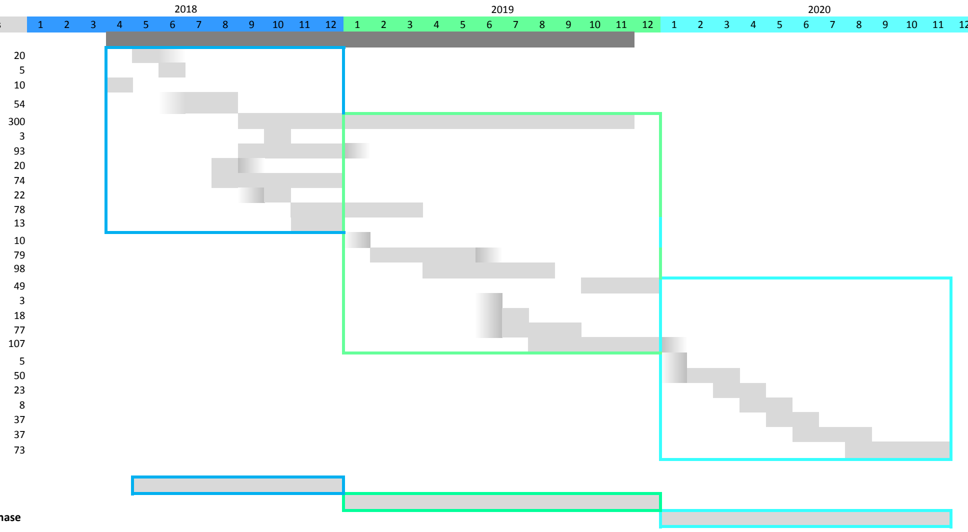
Air Pollutant Emission Calculation Datasheets

Table 1-A: Construction Tasks

	Tasks	Start Date	End Date	Construction Year
Task01	South Property Levee Repair	5/9/2018	6/5/2018	2018
Task02	Plug Existing Culvert	6/6/2018	6/12/2018	2018
Task03	Terrestrial Species control	4/10/2018	4/23/2018	2018
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018
Task05	Maintenance Dewatering (Groundwater)	9/11/2018	11/4/2019	2018-2019
Task06	Aquatic Species control	10/1/2018	10/3/2018	2018
Task07	Clearing and Grubbing	9/11/2018	1/17/2019	2018-2019
Task08	Construct Ramps	8/28/2018	9/24/2018	2018
Task09	Construct Access Roads	8/28/2018	12/7/2018	2018
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018
Task11	Old infrastructure removal	11/20/2018	3/7/2019	2018-2019
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018	2018
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019	2019
Task14	Interior Channel Network	2/15/2019	6/5/2019	2019
Task15	Dry Excavated Material	3/29/2019	8/13/2019	2019
Task16	Remove existing Pump (Southeast corner)	10/1/2019	12/6/2019	2019
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019	2019
Task18	Construct Interior Mounds	6/11/2019	7/4/2019	2019
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019	2019
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020	2019-2020
Task21	Fill borrow ditch	1/20/2020	1/24/2020	2020
Task22	Dredge Miner Slough	1/10/2020	3/19/2020	2020
Task23	Remove Access Roads	3/20/2020	4/21/2020	2020
Task24	Remove Ramps	4/22/2020	5/1/2020	2020
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020
Task27	Planting and revegetation	8/14/2020	11/24/2020	2020

Table 1-B Estimated Construction Implementation Timing (Table 2.2-6. of the DEIR)

	Proposed Project	Start Date	End Date	notes	num of workdays
Construction Tasks		5/9/2018	11/4/2019		
Task01	South Property Levee Repair	5/9/2018	6/5/2018		20
Task02	Plug Existing Culvert	6/6/2018	6/12/2018		5
Task03	Terrestrial Species control	4/10/2018	4/23/2018		10
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018		54
Task05	Maintenance Dewatering (Groundwater)	9/11/2018	11/4/2019		300
Task06	Aquatic Species control	10/1/2018	10/3/2018		3
Task07	Clearing and Grubbing	9/11/2018	1/17/2019		93
Task08	Construct Ramps	8/28/2018	9/24/2018		20
Task09	Construct Access Roads	8/28/2018	12/7/2018		74
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018		22
Task11	Old infrastructure removal	11/20/2018	3/7/2019		78
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018		13
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019		10
Task14	Interior Channel Network	2/15/2019	6/5/2019		79
Task15	Dry Excavated Material	3/29/2019	8/13/2019		98
Task16	Remove existing Pump (Southeast corner)	10/1/2019	12/6/2019		49
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019		3
Task18	Construct Interior Mounds	6/11/2019	7/4/2019		18
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019		77
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020		107
Task21	Fill borrow ditch	1/20/2020	1/24/2020		5
Task22	Dredge Miner Slough	1/10/2020	3/19/2020		50
Task23	Remove Access Roads	3/20/2020	4/21/2020		23
Task24	Remove Ramps	4/22/2020	5/1/2020		8
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020		37
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020		37
Task27	Planting and revegetation	8/14/2020	11/24/2020		73



Construction Phases for Air Quality Calculation

2018 Construction
2019 Construction
2020 Construction Phase

Overlapping Tasks

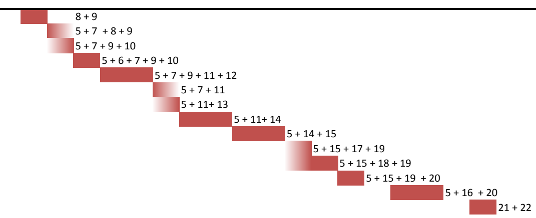


Table 2 Timing, Equipment and Other Details of Construction Tasks

Equipment List and hours

Index Number	Task	Quantities	Current PD Table 2.2-2	Units	Acreage	Start Date	End Date	Production Rate	Description/Notes/Assumptions	Days	815F Sheepfoot Compactor		RT Sheepfoot 60"		Barge Mounted Dredge		D-6H Dozer		LGP 325L Excavator		LGP 375L Excavator		Telescopic Handler (Forklift)		950G Rubber Tire Loader		140H Motor Grader		Cat. 740C Offroad Dump Tru		10 Wheel Dump 10 TON		Semi End Dump 20 TON		Water Truck 3600 gallon		Foreman Op PU 4x2 TON		Service Truck		Pickup 4x4 3/4 TON		Flatbed 2 TON		RT Crane 30 Ton		RT Crane 60 Ton		Small Generator (5 kW?)		Large Generator (25kW?)		Concrete Crane Pump Truck		Helicopter		Drill Rig		Tub Grinder		
											QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	QTY	HRS[1]	
1	**South Property Levee Repair**					5/9/2018	6/5/2018			15																											1	60																								
-	Fill Placement	4,500	3000	CY	0.6	5/22/2018	5/28/2018		50% increase for imported material	15	2	240					2	240									2	240							1	60					1	120																				
-	Sheet Piles	200	200	LF		5/11/2018	5/21/2018	30 LF/day	Unrealistic increase is needed. % increase not incorporated	7													1	21															1	14							1	56			1	56								
-	Geotextile	10,000	10,000	SQ FT		5/29/2018	5/29/2018			2													1	16																	1	8					1	16													Additional 10,000 used
-	Stone Armoring (Rip Rap)	400	200	TONS		5/30/2018	6/5/2018		100% increase for imported material	5											1	40																			1	20																		
2	**Plug Existing Culvert**					5/9/2018	5/11/2018			3																											1	12																								
-	Remove Gangway and Gate	NA								1																					1	2							1	8					1	8			1	8										
-	Seal end of pipe	NA							Pipe est. 4' Dia x 80' long	1																													1	8									1	8										
-	Fill pipe with Concrete/CLSM	40		CY				8 CY/truck	est. 37 CY (round up to 40 CY)	1																																											1	4						
3	**Terrestrial Species control**					4/10/2018	4/23/2018			27																											1	108																								
-	Spot Treatment	6.4	6.4	ACRE						27																															1	160																		
4	**Initial Dewatering (Surface Water)**					6/13/2018	8/27/2018		Assume discharge from North to South & South to North to avoid the need for settling ponds	76																											1	152																								
-	Sheet Piles	660	660	LF		6/15/2018	6/22/2018	30 LF/day		22													2	132															1	44							2	352			2	352								
-	Place & Compact Fill for Pump Platforms	1,560	1560	CY		6/22/2018	6/28/2018			7			2	56							2	112			1	28															1	28																		
-	Excavate Sumps	(500)	6	CY		6/29/2018	6/29/2018		Assume excavate 50'x10'x5' w/ 2:1 sloped sump pit	1											2	16									8	64									1	4																		
-	Setup/Install Temporary Pumps & Pipes	Job	6	Job		7/2/2018	7/6/2018		6 pumpstations & discharge pipe	10													1	80															1	20					1	80			1	20										
-	Clear Existing Agricultural Ditches & Move trapped water to pumps	21	21	AC	62	7/9/2018	7/30/2018			16							1	16			3	384											9	1152							1	32																		
-	Pumping	20	NA	Days		7/31/2018	8/27/2018		Assumptions: 1 generator for each pump platform (6 total). 24/7 pumping.	20																													1	480											6	2880								
5	**Maintenance Dewatering (Groundwater)**					9/11/2018	11/4/2019			300																																																		
-	drill wells	10	NA	EA					Qty estimated. Not clear what is needed for dewatering	30																													1	60					1	60											1	240		
-	Excavate Sumps	6	NA	EA					Qty estimated. Not clear what is needed for dewatering	10											1	80									2	160									1	40																		
-	Setup/Install Temporary Pumps & Pipes	Job		Job					Equals -> # pumps x 3-days	120													1	960															1	240					1	960			1	240										
-	Pumping	140	NA	Days					Assume 10 day/month (8 hrs/day) for 14 months following surface dewatering. Assume half the pumps are operational at any one time (2 pumps per generator)	140																													1	1120											8	8960								
6	**Aquatic Species control**					10/1/2018	10/31/2018			1																											1	32																								
-	Aquatic aerial spraying	411	1256	ACRE	411			250 Ac/Hr	Time inlcudes travel to and from site. Production rate based off of info received from Gina.	1																																													1	8				
7	**Clearing**					9/11/2018	1/17/2019			93																											1	372																								
-	Clear and Grub	156	1256	ACRE	156				Trucks for removal are in "Deliveries"	93							6	4464	2	744					1	744			2	744					2	1488					1	186																		
-	Clear and Disk	504			504																																																						1	290	
8	**Construct Ramps**					8/28/2018	9/24/2018		12 ramps	16																											1	32																								
-	Grade/Prep subbase	NA	8000							6			1	24			1	48							1	48																																		
-	Place and Compact Fill	7,500		CY	1					8			2	128			2	128									2	128							2	64					1	16																		
-	Place and Compact AB	500		CY	1					2			2	32			2	32									2	32							2	16					1	4																		
9	**Construct Access Roads**					8/28/2018	12/7/2018		If site cannot be dewatered	64																											1	128																								
-	Grade subbase	NA	NA							18			1	72			1	144							1	144																																		
-	Geotextile	10,000	10,000	SQ FT						2													1	16																	1	8					1	16												
-	Place and Compact Fill	39,000	26000	CY	16.1				50% increase for imported material	38			2	608			2	608									2	608							2	304					1	76																		
-	Place and Compact AB	3500	NA	CY						6			2	96			2	96									2	96							2	48					1	12																		
10	**Temporary Staging Areas**					9/25/2018	10/24/2018			18																												36																								
-	Place and Compact AB	30000	20000	CY	31.8				50% increase for imported material	18			2	288			2	288									2	288							2	144																								
11	**Old infrastructure removal**					11/20/2018	3/7/2019			5																											1	10																								
-	Remove Abandoned structures	2	NA	EA					Trucks for removal are in "Deliveries"	5							1	40			1	40																			1	20																		
12	**Remove Pump Stations (6)**					11/20/2018	12/6/2018			13																											1	52																								
-	Remove Pumps and Piping	Job		Job						5													1	40															1	10					1	40			1	10										
-	Excavate Fill for Pump Platforms	(1,560)		CY	0.25					3											1	24											3	72	1	24					1	12																		
-	Remove Sheetpiles	(660)		LF				150 LF/day		5													1	15															1	10							1	40			1	40								
13	**Excavate (Cross Levee)**					1/18/2019	1/31/2019			20																											1	80																								
-	construct breach	(20,000)	20000	CY	2					20											2	320											6	960	1	160					1	80																		
14	**Interior Channel Network**					2/15/2019	6/5/2019			79																											1	316																								
-	Excavate Interior Tapered Connections	(61,000)	61,000	CY	59.4					56											3	1344											9	4032	1	448					1	224																		
-	Excavate Interior Channel Network	(335,200)	335,200	CY					includes transport within island	79											6	3792											18	11376	2	1264					1	316																		
15	**Dry Excavated Material**		NA			3/29/2019	8/13/2019			98																																																		
-	Transport/Spread material for drying	396,200		CY	0					98							3	2352									3	2352							1	392					1	784																		

16	**Remove existing Pump (Southeast corner)**					10/27/2020	11/24/2020			**5**																											1	20																						
	- Remove pump	Job		Job						4													1	16							1	32							1	8					1	32			1	16											
	- Plug Pipes through levee (concrete) ???	22		CY					assume plug (2) 3' & (1) 1' Dia. pipes 40' length	1																																											1	8							
17	**Fill Agricultural Ditches**	17,000	17000	CY	2	6/6/2019	6/10/2019			4	3	96					3	96																			1	32					1	16																		
18	**Construct Interior Topographic Features**	27,000	27000	CY	3	6/11/2019	7/4/2019			18	3	432					3	432									3	432							2	288					1	72																		
19	**Construct Eastern Toe Berm**	139,000	139,000	CY	18.5	6/6/2019	9/20/2019			77	3	1848					3	1848									3	1848							2	1232					1	308																		
20	**Construct Intertidal Bench**	340,000	340,000	CY	66.5	8/14/2019	1/9/2020			107	6	5136					6	5136									6	5136							3	2568					2	856																		
21	**Fill borrow ditch**	4,000		CY	3	1/20/2020	1/24/2020			3	2	48					2	48									2	48							1	24					1	12																		
22	**Dredge Miner Slough**					1/10/2020	3/19/2020			**50**																											1	200																						
	- Construct Berm (disposal site)	6,600		CY	1				Assume 8' tall berm w/ 16' wide top & 2:1 slopes. 700' in length	20	2	320					2	320									2	320							1	80					1	160																		Volume = 256sf * 700'
	- Dredge	(47,000)	47000	CY	5			1600 CY/day[2]		30					1	240																																												Average range from US
	- Offload and Transport material	NA							Assume dredge cannot reach top of levee. Another crane/ longreach excavator is needed	30											1	240											6	1440																										
	- Placement and Compaction	NA			12					30	3	720					3	720									3	720							2	240					1	60																		
23	**Remove Access Roads**					3/20/2020	4/21/2020			**23**																											1	92																						
	- excavate/remove Access Roads	(26,000)		CY	0.3					23							1	184			1	184			1	184							8	1472	1	184					2	184																		
24	**Remove Ramps**					4/22/2020	5/1/2020			**8**																											1	32																						
	- Excavate/remove Ramps	(8,000)	-8000	CY	0.3					8							1	64			1	64											3	192	1	64					2	64																		
25	**Breach (Northern Breach)**					5/4/2020	6/23/2020			**37**																											1	74																						
	- ~~Temp Sheet Pile Install~~	~~400~~	~~200~~	~~LF~~				30 LF/day	100% increase for imported material	13													1	39															1	26									1	104			1	104									
	- Excavate Breach	(25,400)	25300	CY	1.5					22											2	352											6	1056	1	176					1	176																		
	- place rip rap	120	NA	TON					Suggest Increasing	2											2	32																					1	16																
	- ~~Remove Temp Sheet Piles~~	~~(400)~~		~~LF~~				150 LF/day		3													1	9															1	6									1	24			1	24									
26	**Breach (Southern Breach)**					6/24/2020	8/13/2020			**37**																											1	74																						
	- ~~Temp Sheet Pile Install~~	~~400~~	~~200~~	~~LF~~				30 LF/day	100% increase for imported material	13													1	39															1	26									1	104			1	104									
	- Excavate Breach	(25,400)	25300	CY	1.5					22											2	352											6	1056	1	176					1	176																		
	- place rip rap	120	NA	TON					Suggest Increasing	2											2	32																					1	16																
	- ~~Remove Temp Sheet Piles~~	~~(400)~~		~~LF~~				150 LF/day		3													1	9															1	6									1	24			1	24									
27	**Planting and revegetation**					8/14/2020	11/24/2020			**15**																											1	60																						
	- Wetland Planting	39	39	ACRE	19				Used estimate from Stillwater spreadsheet	12									1	48					2	192															2	192																	1	24			
	- Riparian Planting				80																																																								
	- ~~Experimental Planting~~	~~5~~	~~5~~	~~ACRE~~					Used estimate from Stillwater spreadsheet	3									1	12					2	48															2	48																	1	6			
**Total Time												8840		1304		240		17304		804		7408		1392		1388		12248				258		22808		9476		1942		2086		4474		32		1180		736		302		12544		12		8		270		290	
Max # of equipment needed												6		2		1		6		2		6		2		2		6				8		18		3		1		1		2		1		1		2		1		8		1		1		1		1	
																																				1185																									

* Rates were taken from Construction office estimate unless otherwise stated in desicription box
**This does not represent the overall schedule since tasks may overlap.

[1] Hours are the combined hours for multiple pieces of equipment
[2] Dredge production rate taken from USACE EM1110 Table 3-5 "Summary of Dredge Operating Characteristics" (realistic avg used)

l in access road construction

/ 3^3 = 6637 CY
;ACE EM1110 Table 3-5 "Summary of Dredge Operating Characteristics

Table 3-A Construction Equipment Descriptions

	Type of Equipment	HorsePower	Source
1	815F Sheepfoot Compactor	253	http://www.ritchiespecs.com/specification?type=&category=Compactor&make=Caterpillar&model=815F&modelid=93380
2	RT Sheepfoot 60"	148	http://www.constructionequipment.com/volvo-sd75b-sd115b-gives-operator-control
3	Barge Mounted Dredge	Based one excavator	
4	D-6H Dozer	165	http://www.ritchiespecs.com/specification?type=Con&category=Crawler+Tractor&make=Caterpillar&model=D6H+LGP&modelid=103768
5	LGP 325L Excavator	168	http://www.ritchiespecs.com/specification?type=Construction+Equipment&category=Hydraulic+Excavator&make=Caterpillar&model=325B+L&modelid=104006
6	LGP 375L Excavator	428	http://www.ritchiespecs.com/specification?type=&category=Hydraulic+Excavator&make=Caterpillar&model=375&modelid=92911
7	Telescopic Handler (Forklift)	135	http://www.ritchiespecs.com/specification?type=&category=Telescopic+Forklift&make=Caterpillar&model=TL1255&modelid=94392
8	950G Rubber Tire Loader	130	http://www.ritchiespecs.com/specification?type=Con&category=Wheel+Loader&make=Caterpillar&model=950&modelid=91545
9	140H Motor Grader	185	http://www.ritchiespecs.com/specification?type=&category=Motor+Grader&make=Caterpillar&model=140H&modelid=91709
10	10 Wheel Dump 10 TON	290	http://www.ritchiewiki.com/wiki/index.php/Dump_Truck
11	Semi End Dump 20 TON	445	http://www.ritchiespecs.com/specification?category=Articulated+Dump+Truck&make=CATERPILLAR&model=740&modelid=91910
12	Water Truck 3600 gallon	275	http://www.truckpaper.com/list/list.aspx?catid=240&Manu=KENWORTH&bcatid=27
13	Foreman Op PU 4x2 TON	75	https://books.google.com/books?id=ovglY5i7R3YC&pg=SA2-PA188&lpg=SA2-PA188&dq=Pickup+4x2+Ton+hp&source=bl&ots=OS98VoVo3K&sig=Wq_AuZvKfQm8qupitBJG689pbvk&hl=en&sa=X&ved=0CB4Q6AEwAGoVChMIs-bGkczvxgIVDaWICh0CPACz#v=onepage&q=Pickup%204x2%20Ton%20hp&f=false
14	Service Truck	300	http://www.truckpaper.com/list/list.aspx?catid=267&Manu=ISUZU&bcatid=27
15	Pickup 4x4 3/4 TON	130	https://books.google.com/books?id=ovglY5i7R3YC&pg=SA2-PA188&lpg=SA2-PA188&dq=Pickup+4x4+3/4+Ton+hp&source=bl&ots=OS98VoVp7P&sig=q2o3Dv6CrwJoXadEYuHiDBnNahE&hl=en&sa=X&ved=0CD8Q6AEwBWoVChMIopGA18zvxgIVDJyICh06BwKL#v=onepage&q=Pickup%204x4%203%2F4%20Ton%20hp&f=false
16	Flatbed 2 TON	275	http://www.commercialtrucktrader.com/Chevrolet-Flatbed-Dump-Trucks-For-Sale/search-results?category=flatbed%20dump%7C2011212&make=CHEVROLET%7C2309502
17	RT Crane 30 Ton	152	http://www.kellytractor.com/eng/images/pdf/cranes/rt8030f.pdf
18	RT Crane 60 Ton	270	http://www.linkbelt.com/lit/pdf/rtc/8065ii/rt8065iit.pdf
19	Small Generator (5 kW?)	6.7	Calculated directly
20	Large Generator (25kW?)	33.5	Calculated directly
21	Concrete Crane Pump Truck	330	http://www.constructionequipment.com/concrete-pumps
22	Helicopter	317	https://en.wikipedia.org/wiki/Bell_206
23	Drill Rig	Hydraulic 200 hp, truck 213 hp	http://www.mobiledrill.net/new-drill-rigs/MS1000
24	Tub Grinder	350	http://www.urcrecycle.com/category/tub-grinder/

Table 3-B Equipment Mobilization and Demobilization

Mobilization & Demobilization

Type of Equipment	Max # Equipment Required	Delivery Equipment	Roundtrip Distance to manufacturer (miles)	Assumed source	Mobilization Miles Travelled[2]	Demobilization Miles Travelled[2]	Total Miles Travelled[2]
815F Sheepfoot Compactor	6	Lowboy truck/trailer	30	From Dutra in Rio Vista	180	180	360
RT Sheepfoot 60"	2	Lowboy truck/trailer	30	From Dutra in Rio Vista	60	60	120
D-6H Dozer	6	Lowboy truck/trailer	30	From Dutra in Rio Vista	180	180	360
325L Excavator	2	Lowboy truck/trailer	30	From Dutra in Rio Vista	60	60	120
375L Excavator	6	Lowboy truck/trailer	30	From Dutra in Rio Vista	180	180	360
Telescopic Handler	2	Lowboy truck/trailer	30	From Dutra in Rio Vista	60	60	120
950G Rubber Tire Loader	2	Lowboy truck/trailer	30	From Dutra in Rio Vista	60	60	120
140H Motor Grader	6	Lowboy truck/trailer	30	From Dutra in Rio Vista	180	180	360
10 Wheel Dump 10 TON	8	Self delivered	30	From Dutra in Rio Vista	240	240	480
Semi End Dump 20 TON	18	Self delivered	30	From Dutra in Rio Vista	540	540	1080
Water Truck 3600 gallon	3	Self delivered	30	From Dutra in Rio Vista	90	90	180
4 Man Op PU 4x2 TON	1	Self delivered	30	From Dutra in Rio Vista	30	30	60
Pickup 4x2 1 TON	1	Self delivered	30	From Dutra in Rio Vista	30	30	60
Pickup Flatbed 4x4 3/4 TON	2	Self delivered	30	From Dutra in Rio Vista	60	60	120
Flatbed 2 TON	1	Self delivered	30	From Dutra in Rio Vista	30	30	60
RT Crane 60 Ton	2	Self delivered	60	med from vendor in Sacram	120	120	240
Generator	8	Pickup truck/1 each	60	Rent Construction Yard Sacra	480	480	960
Well Augur Rig	1	Lowboy truck/trailer	60	Rent Construction Yard Sacra	60	60	120
Helicopter	1	Self delivered	60	Sacramento	60	60	120
Total # Trips	156	**Avg Distance**	36.31578947			**Total Miles**	5400

[1] Total Miles = Qty x Roundtrip Distance

[2] Total Miles = # Equipment x Roundtrip Distance

Table 4 Material Deliveries

Material Transportation

Type of material	Quantity	Current PD Table 2.2-2	Unit	Method of Transportation	Capacity per trip (unit/trip)	Roundtrip Distance to manufacturer (miles)	Assumed Source/Destination	Total Miles Travelled[1]	
Geotextile	20,000	20,000	SF	Flatbed	10,000	60	From stockpiles in Sacramento	120	
Sheet Piles	860	2520	LF	FLATBED	5 pile pairs/truck	166	From LB Foster Piling vendor in Union City	4759	6 LF = 1 pile pair
Concrete	62		CY	Concrete Truck	8	60	From Sacramento	465	
Plants	50		trips	Truck		60	From Sacramento	3000	~49 Acres of plantings & hydro-seed per Stillwater (assume 1 trip per acre)
Fuel	45		trips	Refueling Truck		60	From Sacramento	2700	Assume refueling trip every-other day during Surface Dewatering. Trip every 4 days during Maintenance De

Import Fill Material - By Barge

Type of material	Quantity	Current PD Table 2.2-2	Transport method	Unit	Capacity per trip (Unit/trip)	Conversion (Ton/CY)	# of Trips	Roundtrip Distance to manufacturer (miles)	Operation Speed (MPH)	Assumed Source/Destination	Total Hours of Operation	Total Miles Travelled	
Import Fill	59160	117120	Truck	CY	10	Already in CY/trip	5916	1		from source to barge		5916	assume 10 CY end-dum
			Barge		4000	1.3	20	14	4	Fill from Dutra in Rio Vista	70		
			Truck		10	Already in CY/trip	5916	3		Barge to Placement Location		17748	assume 10 CY end-dum

Rip Rap Material - By Barge

Type of material	Quantity	Current PD Table 2.2-2	Transport method	Unit	Capacity per trip (Unit/trip)	Conversion (Ton/CY)	# of Trips	Roundtrip Distance to manufacturer (miles)	Operation Speed (MPH)	Assumed Source/Destination	Total Hours of Operation	Total Miles Travelled	
Rip Rap	1,640	1640	Truck	Ton	22	Already in Ton/trip	75	1		from source to barge		75	assume 22 Ton capacit
			Barge		4000	Already in Ton/trip	1	14	4	Fill from Dutra in Rio Vista	4		
			Truck		22	Already in Ton/trip	75	3		Barge to Placement Location		225	assume 22 Ton capacit

Aggregate Base Material - By Barge

Type of material	Quantity	Current PD Table 2.2-2	Transport method	Unit	Capacity per trip (Unit/trip)	Conversion (Ton/CY)	# of Trips	Roundtrip Distance to manufacturer (miles)	Operation Speed (MPH)	Assumed Source/Destination	Total Hours of Operation	Total Miles Travelled	
Agg. Base	34000	NA	Truck	CY	10	Already in CY/trip	3400	1		from source to barge		3400	assume 10 CY end-dum
			Barge	CY	4000	1.3	12	14	4	Fill from Dutra in Rio Vista	42		
			Truck	CY	10	Already in CY/trip	3400	3		Barge to Placement Location		10200	assume 10 CY end-dum

Import Material - By Truck

Type of material	Quantity	Current PD Table 2.2-2	Unit	Method of Transportation	Capacity per trip (unit/trip)	Roundtrip Distance to manufacturer (miles)	Assumed Source/Destination	Total Miles Travelled[1]	
Import Fill	59160	117120	CY	18 Wheel Truck	20	60	Fill from Dutra in Rio Vista	177480	assume 20 CY capacity transfer-truck
Rip Rap	1,640	1640	Tons	18 Wheel Truck	22	60	Assuming taken from Rio Vista stockpiles	4473	assume 22 Ton capacity end-dump truck
AB	34000	NA	CY	18 Wheel Truck	20	60	From Dutra in Rio Vista	102000	assume 20 CY capacity transfer-truck
	94,800								

watering

ıp trucks used

ıp trucks used

y end-dump truck

y end-dump truck

ıp trucks used

ıp trucks used

Table 5-A Off-Road Construction Equipment Hourly Emissions from Road Construction Emissions Mode

Emission rates are from Road Construction Emissions Model, Version 7.1.5.1

Each phase is set to 12 months, so Grubbing/Land Clearing phase is for year 2018, Grading/Excavation phase is for year 2019, Drainage/Utilities/Sub-Grade phase is for year 2020 and paving phase is for year 2021

	for Equipment Set A						
	for Equipment Set B	0.094386888	0.827737072	1.07404558	0.04067996	0.037425564	158.7796329

	Road Construction Emissions Model Assumptions	2018						2019						2020					
		Emissions (pounds per hour)						Emissions (pounds per hour)						Emissions (pounds per hour)					
		ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
815F Sheepfoot Compactor	Roller, 253 horsepower	0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	0.051429	0.599446	0.591347	0.022878	0.021047	111.030255
RT Sheepfoot 60"	Roller, 148 horsepower	0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	0.027551	0.345245	0.299880	0.013775	0.012673	63.946723
Barge Mounted Dredge	Crane, 270 horsepower	0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	0.057492	0.447929	0.661777	0.026526	0.024404	89.699404
Dozer (D-6H Dozer)	Crawler Tractors, 165 horsepower	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	0.077651	0.440637	0.759299	0.042419	0.039025	81.320666
LGP 325L Excavator	Excavator, 168 horsepower	0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	0.034218	0.359992	0.321981	0.015596	0.014349	73.942541
LGP 375L Excavator	Excavator, 428 horsepower	0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	0.057797	0.913251	0.565964	0.018647	0.017155	187.582279
Telescopic Handler (Forklift)	Forklift, 142 horsepower	0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	0.022246	0.179179	0.208696	0.011297	0.010393	32.881502
950G Rubber Tire Loader	Rubber Tire Load, 225 horsepower	0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	0.054465	0.438454	0.613435	0.020364	0.018735	93.266561
140H Motor Grader	Grader, 185 horsepower	0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	0.061334	0.455049	0.779056	0.024906	0.022913	87.695050
RT Crane 30 Ton	Crane, 152 horsepower	0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	0.054200	0.253254	0.537233	0.028727	0.026429	50.715012
RT Crane 60 Ton	Crane, 270 horsepower	0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	0.057492	0.447929	0.661777	0.026526	0.024404	89.699404
Small Generator	Generate Set, 10 horsepower	0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	0.010670	0.057976	0.074537	0.003611	0.003322	9.263038
Large Generator	Generate Set, 33.5 horsepower	0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	0.042379	0.227131	0.234202	0.012340	0.011352	31.031175
Concrete Crane Pump Truck	Other material handling equipment, 330 horsepower	0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	0.084951	0.780438	0.922264	0.034414	0.031661	149.706511
Tub Grinder	Other material handling equipment, 350 horsepower	0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	0.090100	0.827737	0.978159	0.036500	0.033580	158.779633
Drill Rig	Drill Rig, 206 horsepower default value	0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	0.033980	0.473745	0.412080	0.011873	0.010923	117.921634
10 Wheel Dump 10 TON	Off-Highway Trucks, 290 horsepower	0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	0.062838	0.388319	0.572483	0.020858	0.019189	128.257698
Semi End Dump 20 TON	Off-Highway Trucks, 490 horsepower	0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	0.106175	0.656125	0.967299	0.035242	0.032423	216.711283

Table 5-B Hourly Emissions for Pickup Trucks, Water Trucks, Service Trucks from Road Construction Emissions Model

Equipment	Road Construction Emissions Model Assumptions	2018						2019						2020					
		Hourly Emissions for Each Vehicle(pounds per hour)						Hourly Emissions for Each Vehicle(pounds per hour)						Hourly Emissions for Each Vehicle(pounds per hour)					
		ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Foreman Op PU 4x2 TON	Road Construction Emissions Model, light duty truck, assume 100 mile per day	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047
Pickup 4x4 3/4 TON	Road Construction Emissions Model, light duty truck, assume 100 mile per day	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047
Water Truck	Road Construction Emissions Model (assume 40 miles per day)	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125
Service Truck	Road Construction Emissions Model, use water truck (heavy-duty truck assume 100 miles per day)	0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	0.004316	0.019668	0.128643	0.004276	0.002434	42.912812
Flatbed 2 TON	Road Construction Emissions Model, use water truck (heavy-duty truck assume 100 miles per day)	0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	0.004316	0.019668	0.128643	0.004276	0.002434	42.912812

Table 5-C Daily Worker Commute Emissions from Road Construction Emissions Model

	Road Construction Emissions Model Assumptions	2018						2019						2020					
		Daily Emissions for Each Worker (pounds per day)						Daily Emissions for Each Worker (pounds per day)						Daily Emissions for Each Worker (pounds per day)					
		ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Worker Commute	Road Construction Emissions Model, work commute emissions (30 miles one way, one round-trip per day	0.0177	0.1999	0.0215	0.0062	0.0026	59.0842	0.0165	0.1843	0.0195	0.0062	0.0026	58.8018	0.0155	0.1704	0.0179	0.0062	0.0026	58.8177

Table 5-D Daily PM Emissions for Each Acre of Land Disturbance from Road Construction Emissions Model

	Road Construction Emissions Model Assumptions	Daily PM Emissions for Each Acre of Land (pounds per day)					
		ROG	CO	NOx	PM10	PM2.5	CO2
Land Disturbed					10.0000	2.0800	

Table 5-E Hourly Emissions for Helicopter

	Assumptions	Emissions (pounds per hour)					
		ROG	CO	NOx	PM10	PM2.5	CO2
Helicopter	See Appendix 2: Helicoptor Emission	6.11248	7.76420	3.92819	0.12203	0.12203	1993.01329

Table 5-F Hourly for Barge and Tug boat

	Assumptions	Emissions (pounds per hour)					
		ROG	CO	NOx	PM10	PM2.5	CO2
Barge and Tug Boat	See Appendix 1: Emissions from Barges and Tug Boat	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034

Table 5-G Emissions Per Vehicle-Miles-Travelled for On-road Trucks

	Road Construction Emissions Model Assumptions	2018						2019						2020					
		Emissions Rates (grams per mile)						Daily Emissions for Each Worker (pounds per day)						Daily Emissions for Each Worker (pounds per day)					
		ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Heavy On-Road Trucks	from the water truck section of the Roadway Model	0.14913143	0.673237769	6.662928787	0.155946827	0.089010566	1624.614821	0.152689658	0.692092622	5.876773556	0.155859671	0.088930381	1596.493543	0.156764041	0.714336426	4.672320593	0.155299655	0.088415167	1558.593331

Materials Deliveries Part I: Geotextile, Sheet Piles, Concrete, and Fuel etc

Table 6-1: emissions from importing geotextile, sheet piles, concrete and fuel

													Emission rate (grams/mile)						Total Emissions (pounds)					
Task #	Tasks	Start	End	Year	Materials	Quantity	Unit	Method	Capacity per trip (unit/trip	Trips	Miles per Trip	Vehicle Miles	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Geotextile	10000	SQ FT	trucks	10000	1	60	60	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.01973	0.08905	0.88136	0.02063	0.01177	214.90088
					Sheet Piles	200	LF	trucks	30	7	166	1162	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.38204	1.72469	17.06899	0.39950	0.22803	4161.91367
T-02	Plug existing culvert	6/6/2018	6/12/2018	2018	Concrete	40	CY	trucks	8	5	60	300	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.09863	0.44527	4.40680	0.10314	0.05887	1074.50439
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Sheet Piles	660	LF	trucks	30	22	166	3652	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	1.20071	5.42046	53.64540	1.25558	0.71665	13080.30011
					Pump Fuel	10	trips	trucks	1	10	60	600	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.19727	0.89055	8.81359	0.20628	0.11774	2149.00878
T-05	Maintenance Dewatering (Groundwater)	9/11/2018	11/4/2019	2018-2019	Pump Fuel	35	trips	trucks	1	35	60	2100	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.69044	3.11691	30.84757	0.72199	0.41210	7521.53073
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018	Geotextile	10000	SQ FT	trucks	10000	1	60	60	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.01973	0.08905	0.88136	0.02063	0.01177	214.90088
T-16	Remove existing Pump (Southeast corner)	10/27/2019	12/6/2019	2019	Concrete	22	CY	trucks	8	3	60	180	0.15269	0.69209	5.87677	0.15586	0.08893	1596.49354	0.06059	0.27465	2.33210	0.06185	0.03529	633.54315
T-27	Planting and revegetation	8/14/2020	11/24/2020	2020	Plants	50	trips	trucks	1	50	60	3000	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	1.03682	4.72455	30.90227	1.02714	0.58477	10308.38421

Materials Deliveries Part II : Rip Rap, Fill Material and Aggregate Base

Option A: Imported by trucks

Table 6-2-A Option A Emissions (emissions from trucks)

													Emission rate (grams/mile)						Total Emissions (pounds)					
Task #	Tasks	Start	End	Year	Materials	Quantity	Unit	Method	Capacity per trip (unit/trip	Trips	Miles per Trip	Vehicle Miles	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Rip Rap	400	tons	trucks	22	19	60	1140	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.37	1.69	16.75	0.39	0.22	4083.12
					Fill Material	4500	cy	trucks	20	225	60	13500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	4.44	20.04	198.31	4.64	2.65	48352.70
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Fill Material	1560	cy	trucks	20	78	60	4680	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	1.54	6.95	68.75	1.61	0.92	16762.27
T-08	Construct Ramps	8/28/2018	9/24/2018	2018	Fill Material	7500	cy	trucks	20	375	60	22500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	7.40	33.40	330.51	7.74	4.42	80587.83
					Aggregate Base	500	cy	trucks	20	25	60	1500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.49	2.23	22.03	0.52	0.29	5372.52
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018	Rip Rap	1000	tons	trucks	22	46	60	2760	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.91	4.10	40.54	0.95	0.54	9885.44
					Fill Material	39000	cy	trucks	20	1950	60	117000	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	38.47	173.66	1718.65	40.23	22.96	419056.71
					Aggregate Base	3500	cy	trucks	20	175	60	10500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	3.45	15.58	154.24	3.61	2.06	37607.65
T-10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	Aggregate Base	30000	cy	trucks	20	1500	60	90000	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	29.59	133.58	1322.04	30.94	17.66	322351.32
T-22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	Fill Material	6600	cy	trucks	20	330	60	19800	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	6.84	31.18	203.95	6.78	3.86	68035.34
T-24	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	Rip Rap	120	tons	trucks	22	6	60	360	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	0.12	0.57	3.71	0.12	0.07	1237.01
T-25	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	Rip Rap	120	tons	trucks	22	6	60	360	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	0.12	0.57	3.71	0.12	0.07	1237.01

Option B: Imported by barges and loaded/unloaded by dump-trucks at Project site and Quarry site

Table 6-2-B1 Option B Emissions Part 1 - from dump trucks at the quarry and project site

Emissions from dump trucks

													Emission Rate (pounds/hour)						Total Emissions from Dump Trucks (pounds)					
Task #	Tasks	Start	End	Year	Materials	Quantity (in CY)	Unit	Method	Capacity per trip (tons/trip	Trips	Hours Per Trip	Operation Hours	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Rip Rap	1640	tons	Dump Truck	22	75	1	75	0.12382	0.65675	1.27362	0.04649	0.04277	216.91846	9.29	49.26	95.52	3.49	3.21	16268.88
					Fill Material	4500	cy	Dump Truck	10	450	1	450	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	32.98	174.91	339.20	12.38	11.39	57771.14
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Fill Material	1560	cy	Dump Truck	10	156	1	156	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	11.43	60.64	117.59	4.29	3.95	20027.33
T-08	Construct Ramps	8/28/2018	9/24/2018	2018	Fill Material	7500	cy	Dump Truck	10	750	1	750	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	54.96	291.52	565.33	20.63	18.98	96285.24
					Aggregate Base	500	cy	Dump Truck	10	50	1	50	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	3.66	19.43	37.69	1.38	1.27	6419.02
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018	Rip Rap																			
					Fill Material	39000	cy	Dump Truck	10	3900	1	3900	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	285.80	1515.89	2939.73	107.30	98.71	500683.22
					Aggregate Base	3500	cy	Dump Truck	10	350	1	350	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	25.65	136.04	263.82	9.63	8.86	44933.11
T-10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	Aggregate Base	30000	cy	Dump Truck	10	3000	1	3000	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	219.85	1166.07	2261.33	82.54	75.93	385140.94
T-22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	Fill Material	6600	cy	Dump Truck	10	660	1	660	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	48.37	256.54	497.49	18.16	16.71	84731.01
T-25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	Rip Rap																			
T-26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	Rip Rap																			

Rip Rap 1,640
Imported Fill 59,160
Imported AB 34,000

Table 6-2-B2 Option B Emissions Part 2 - from barges and tug boats

													Emission rate (pounds/hour)						Total Emissions from Barges (pounds)					
Task #	Tasks	Start	End	Year	Materials	Quantity (in CY)	Unit	Method	Capacity per trip (tons/trip	Trips	Miles per Trip	Operation Hours	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Rip Rap	1660	tons	Barges	4000	1	14	4	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	4.45	23.00	101.37	2.61	2.61	12228.24
					Fill Material	4500	cy	Barges	4000	2	14	28	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	31.14	160.98	709.56	18.30	18.30	85597.69
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Fill Material	1560	cy	Barges	4000	1	14	14	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	15.57	80.49	354.78	9.15	9.15	42798.84
T-08	Construct Ramps	8/28/2018	9/24/2018	2018	Fill Material	7500	cy	Barges	4000	2	14	28	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	31.14	160.98	709.56	18.30	18.30	85597.69
					Aggregate Base	500	cy	Barges	4000	1	14	14	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	15.57	80.49	354.78	9.15	9.15	42798.84
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018																				
					Fill Material	39000	cy	Barges	4000	10	14	140	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	155.70	804.92	3547.79	91.49	91.49	427988.45
					Aggregate Base	3500	cy	Barges	4000	1	14	14	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	15.57	80.49	354.78	9.15	9.15	42798.84
T-10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	Aggregate Base	30000	cy	Barges	4000	8	14	112	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	124.56	643.94	2838.23	73.20	73.20	342390.76
T-22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	Fill Material	6600	cy	Barges	4000	2	14	28	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	31.14	160.98	709.56	18.30	18.30	85597.69
T-25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020																				
T-26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020																				

Table 6-2-B Emission Comparison for Two Options of Importing Rip-rap, Fill and Aggregate Base

						Emissions from Option A: Imported by Trucks (pounds)						Emissions from Option B: Barges + Dump Trucks (pounds)						Emissions from Dump Trucks (pounds)						Emissions from Barges (pounds)					
Task #	Tasks	Start	End	Year	Materials	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Rip Rap	0.37	1.69	16.75	0.39	0.22	4083.12	13.74	72.25	196.89	6.10	5.82	28497.13	9.29	49.26	95.52	3.49	3.21	16268.88	4.45	23.00	101.37	2.61	2.61	12228.24
					Fill Material	4.44	20.04	198.31	4.64	2.65	48352.70	64.12	335.90	1048.76	30.68	29.69	143368.83	32.98	174.91	339.20	12.38	11.39	57771.14	31.14	160.98	709.56	18.30	18.30	85597.69
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Fill Material	1.54	6.95	68.75	1.61	0.92	16762.27	27.00	141.13	472.37	13.44	13.10	62826.17	11.43	60.64	117.59	4.29	3.95	20027.33	15.57	80.49	354.78	9.15	9.15	42798.84
T-08	Construct Ramps	8/28/2018	9/24/2018	2018	Fill Material	7.40	33.40	330.51	7.74	4.42	80587.83	86.10	452.50	1274.89	38.93	37.28	181882.92	54.96	291.52	565.33	20.63	18.98	96285.24	31.14	160.98	709.56	18.30	18.30	85597.69
					Aggregate Base	0.49	2.23	22.03	0.52	0.29	5372.52	19.23	99.93	392.47	10.53	10.41	49217.86	3.66	19.43	37.69	1.38	1.27	6419.02	15.57	80.49	354.78	9.15	9.15	42798.84
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018	Rip Rap	0.91	4.10	40.54	0.95	0.54	9885.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					Fill Material	38.47	173.66	1718.65	40.23	22.96	419056.71	441.50	2320.81	6487.52	198.79	190.21	928671.67	285.80	1515.89	2939.73	107.30	98.71	500683.22	155.70	804.92	3547.79	91.49	91.49	427988.45
					Aggregate Base	3.45	15.58	154.24	3.61	2.06	37607.65	41.22	216.53	618.60	18.78	18.01	87731.95	25.65	136.04	263.82	9.63	8.86	44933.11	15.57	80.49	354.78	9.15	9.15	42798.84
T-10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	Aggregate Base	29.59	133.58	1322.04	30.94	17.66	322351.32	344.40	1810.01	5099.56	155.73	149.13	727531.70	219.85	1166.07	2261.33	82.54	75.93	385140.94	124.56	643.94	2838.23	73.20	73.20	342390.76
T-22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	Fill Material	6.84	31.18	203.95	6.78	3.86	68035.34	79.51	417.52	1207.05	36.46	35.00	170328.70	48.37	256.54	497.49	18.16	16.71	84731.01	31.14	160.98	709.56	18.30	18.30	85597.69
T-25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	Rip Rap	0.12	0.57	3.71	0.12	0.07	1237.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	Rip Rap	0.12	0.57	3.71	0.12	0.07	1237.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6-3: Emissions for Deliveries of All Materials (combine the emissions from tables above)

						Total Emissions (pounds) for Option A (import riprap etc by trucks)						Total Emissions (pounds) for Option B (import riprap etc by barges and trucks)					
Task #	Tasks	Start	End	Year	Materials	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Geotextile	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90
					Sheet Piles	0.38	1.72	17.07	0.40	0.23	4161.91	0.38	1.72	17.07	0.40	0.23	4161.91
					Rip Rap	0.37	1.69	16.75	0.39	0.22	4083.12	13.74	72.25	196.89	6.10	5.82	28497.13
					Fill Material	4.44	20.04	198.31	4.64	2.65	48352.70	64.12	335.90	1048.76	30.68	29.69	143368.83
					Total	**5.22**	**23.54**	**233.00**	**5.45**	**3.11**	**56812.63**	**78.25**	**409.96**	**1263.60**	**37.20**	**35.75**	**176242.77**
T-02	Plug existing culvert	5/9/2018	5/11/2018	2018	Concrete	0.38	1.72	17.07	0.40	0.23	4161.91	0.38	1.72	17.07	0.40	0.23	4161.91
					Total	**0.38**	**1.72**	**17.07**	**0.40**	**0.23**	**4161.91**	**0.38**	**1.72**	**17.07**	**0.40**	**0.23**	**4161.91**
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Sheet Piles	1.20	5.42	53.65	1.26	0.72	13080.30	1.20	5.42	53.65	1.26	0.72	13080.30
					Pump Fuel	0.20	0.89	8.81	0.21	0.12	2149.01	0.20	0.89	8.81	0.21	0.12	2149.01
					Fill Material	1.54	6.95	68.75	1.61	0.92	16762.27	27.00	141.13	472.37	13.44	13.10	62826.17
					Total	**2.94**	**13.26**	**131.21**	**3.07**	**1.75**	**31991.58**	**28.40**	**147.44**	**534.83**	**14.90**	**13.93**	**78055.48**
T-05	Maintenance Dewatering (Groundwater)	9/11/2018	11/4/2019	2018-2019	Pump Fuel	0.69	3.12	30.85	0.72	0.41	7521.53	0.69	3.12	30.85	0.72	0.41	7521.53
					Total	**0.69**	**3.12**	**30.85**	**0.72**	**0.41**	**7521.53**	**0.69**	**3.12**	**30.85**	**0.72**	**0.41**	**7521.53**
T-08	Construct Ramps	8/28/2018	9/24/2018	2018	Fill Material	7.40	33.40	330.51	7.74	4.42	80587.83	86.10	452.50	1274.89	38.93	37.28	181882.92
					Aggregate Base	0.49	2.23	22.03	0.52	0.29	5372.52	19.23	99.93	392.47	10.53	10.41	49217.86
					Total	**7.89**	**35.62**	**352.54**	**8.25**	**4.71**	**85960.35**	**105.33**	**552.43**	**1667.36**	**49.46**	**47.70**	**231100.79**
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018	Geotextile	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90
					Rip Rap	0.91	4.10	40.54	0.95	0.54	9885.44	0.00	0.00	0.00	0.00	0.00	0.00
					Fill Material	38.47	173.66	1718.65	40.23	22.96	419056.71	441.50	2320.81	6487.52	198.79	190.21	928671.67
					Aggregate Base	3.45	15.58	154.24	3.61	2.06	37607.65	41.22	216.53	618.60	18.78	18.01	87731.95
					Total	**39.39**	**177.84**	**1760.07**	**41.19**	**23.51**	**429157.05**	**441.52**	**2320.90**	**6488.40**	**198.81**	**190.22**	**928886.57**
T-10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	Aggregate Base	29.59	133.58	1322.04	30.94	17.66	322351.32	344.40	1810.01	5099.56	155.73	149.13	727531.70
					Total	**29.59**	**133.58**	**1322.04**	**30.94**	**17.66**	**322351.32**	**344.40**	**1810.01**	**5099.56**	**155.73**	**149.13**	**727531.70**
T-16	Remove existing Pump (Southeast corner)	10/27/2020	11/24/2020	2019	**Concrete**	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**
					Total	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**
T-22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	Aggregate Base	6.84	31.18	203.95	6.78	3.86	68035.34	79.51	417.52	1207.05	36.46	35.00	170328.70
					Total	**6.84**	**31.18**	**203.95**	**6.78**	**3.86**	**68035.34**	**79.51**	**417.52**	**1207.05**	**36.46**	**35.00**	**170328.70**
					Rip Rap	0.12	0.57	3.71	0.12	0.07	1237.01	0.00	0.00	0.00	0.00	0.00	0.00
					Total	**0.12**	**0.57**	**3.71**	**0.12**	**0.07**	**1237.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
					Rip Rap	0.12	0.57	3.71	0.12	0.07	1237.01	0.00	0.00	0.00	0.00	0.00	0.00
					Total	**0.12**	**0.57**	**3.71**	**0.12**	**0.07**	**1237.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
T-27	Planting and revegetation	7/2/2020	9/23/2020	2020	**Plants**	**1.04**	**4.72**	**30.90**	**1.03**	**0.58**	**10308.38**	**1.04**	**4.72**	**30.90**	**1.03**	**0.58**	**10308.38**

Table 6-4: Summary of Emissions from Material Deliveries for Each Task

		Total Emissions (pounds) for Option A (import riprap etc by trucks)						Total Emissions (pounds) for Option B (import riprap etc by barges and trucks)					
Task #	Tasks	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	5.22	23.54	233.00	5.45	3.11	56812.63	78.25	409.96	1263.60	37.20	35.75	176242.77
T-02	Plug existing culvert	0.38	1.72	17.07	0.40	0.23	4161.91	0.38	1.72	17.07	0.40	0.23	4161.91
T-04	Initial Dewatering (Surface Water)	2.94	13.26	131.21	3.07	1.75	31991.58	28.40	147.44	534.83	14.90	13.93	78055.48
T-05	Maintenance Dewatering (Groundwater)	0.69	3.12	30.85	0.72	0.41	7521.53	0.69	3.12	30.85	0.72	0.41	7521.53
T-08	Construct Ramps	7.89	35.62	352.54	8.25	4.71	85960.35	105.33	552.43	1667.36	49.46	47.70	231100.79
T-09	Construct Access Roads	39.39	177.84	1760.07	41.19	23.51	429157.05	441.52	2320.90	6488.40	198.81	190.22	928886.57
T-10	Interior Staging Area Construction	29.59	133.58	1322.04	30.94	17.66	322351.32	344.40	1810.01	5099.56	155.73	149.13	727531.70
T-16	Remove existing Pump (Southeast corner)	0.06	0.27	2.33	0.06	0.04	633.54	0.06	0.27	2.33	0.06	0.04	633.54
T-22	Dredge Miner Slough	6.84	31.18	203.95	6.78	3.86	68035.34	79.51	417.52	1207.05	36.46	35.00	170328.70
T-25	Breach (Northern Breach)	0.12	0.57	3.71	0.12	0.07	1237.01	0.00	0.00	0.00	0.00	0.00	0.00
T-26	Breach (Southern Breach)	0.12	0.57	3.71	0.12	0.07	1237.01	0.00	0.00	0.00	0.00	0.00	0.00
T-27	Planting and revegetation	1.04	4.72	30.90	1.03	0.58	10308.38	1.04	4.72	30.90	1.03	0.58	10308.38

Materials Deliveries Part I: Geotextile, Sheet Piles, Concrete, and Fuel etc

Table 7-1: emissions from importing geotextile, sheet piles, concrete and fuel

											Emission rate (grams/mile)						Maximum Daily Emissions (pounds)					
Task #	**Tasks**	**Materials**	**Quantity**	**Unit**	**Method**	**Capacity per trip (unit**	**Total Trips**	**Max Daily Trips**	**Miles per Trip**	**Total Vehicle Mile**	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	Geotextile	10000	SQ FT	trucks	10000	1	1	60	60	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.02	0.09	0.88	0.02	0.01	214.90
		Sheet Piles	200	LF	trucks	30	7	7	166	1162	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.38	1.72	17.07	0.40	0.23	4161.91
T-02	Plug existing culvert	Concrete	40	CY	trucks	8	5	5	60	300	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.10	0.45	4.41	0.10	0.06	1074.50
T-04	Initial Dewatering (Surface Water)	Sheet Piles	660	LF	trucks	30	22	6	166	996	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.33	1.48	14.63	0.34	0.20	3567.35
		Pump Fuel	10	trips	trucks	1	10	1	60	60	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.02	0.09	0.88	0.02	0.01	214.90
T-05	Maintenance Dewatering (Groundwater)	Pump Fuel	35	trips	trucks	1	35	1	60	60	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.02	0.09	0.88	0.02	0.01	214.90
T-09	Construct Access Roads	Geotextile	10000	SQ FT	trucks	10000	1	1	60	60	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.02	0.09	0.88	0.02	0.01	214.90
T-16	Remove existing Pump (Southeast corner)	Concrete	22	CY	trucks	8	3	3	60	180	0.15269	0.69209	5.87677	0.15586	0.08893	1596.49354	0.06	0.27	2.33	0.06	0.04	633.54
T-27	Planting and revegetation	Plants	50	trips	trucks	1	50	5	60	300	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	0.10	0.47	3.09	0.10	0.06	1030.84

Materials Deliveries Part II : Rip Rap, Fill Material and Aggregate Base

Option A: Imported by trucks

Table 7-2-A Option A Emissions (emissions from trucks)

												Emission rate (grams/mile)						Maximum Daily Emissions (pounds)					
Task #	**Tasks**	**Materials**	**Quantity**	**Unit**	**Method**	**Capacity per trip (unit**	**Trips**	**Work Days**	**Max Daily Trips**	**Miles per Trip**	**Vehicle Miles**	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	Rip Rap	400	tons	trucks	22	19	5	7	60	420	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.14	0.62	6.17	0.14	0.08	1504.31
		Fill Material	4500	cy	trucks	20	225	15	20	60	1200	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	**0.39**	**1.78**	**17.63**	**0.41**	**0.24**	**4298.02**
T-04	Initial Dewatering (Surface Water)	Fill Material	1560	cy	trucks	20	78	7	12	60	720	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	**0.24**	**1.07**	**10.58**	**0.25**	**0.14**	**2578.81**
T-08	Construct Ramps	Fill Material	7500	cy	trucks	20	375	8	50	60	3000	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	**0.99**	**4.45**	**44.07**	**1.03**	**0.59**	**10745.04**
		Aggregate Base	500	cy	trucks	20	25	2	13	60	780	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.26	1.16	11.46	0.27	0.15	2793.71
T-09	Construct Access Roads	Rip Rap	1000	tons	trucks	22	46		25	60	1500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	0.49	2.23	22.03	0.52	0.29	5372.52
		Fill Material	39000	cy	trucks	20	1950	38	75	60	4500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	**1.48**	**6.68**	**66.10**	**1.55**	**0.88**	**16117.57**
		Aggregate Base	3500	cy	trucks	20	175	6	75	60	4500	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	1.48	6.68	66.10	1.55	0.88	16117.57
T-10	Interior Staging Area Construction	Aggregate Base	30000	cy	trucks	20	1500	18	90	60	5400	0.14913	0.67324	6.66293	0.15595	0.08901	1624.61482	**1.78**	**8.01**	**79.32**	**1.86**	**1.06**	**19341.08**
T-22	Dredge Miner Slough	Fill Material	6600	cy	trucks	20	330	20	20	60	1200	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	**0.41**	**1.89**	**12.36**	**0.41**	**0.23**	**4123.35**
T-25	Breach (Northern Breach)	Rip Rap	120	tons	trucks	22	6		9	60	540	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	**0.19**	**0.85**	**5.56**	**0.18**	**0.11**	**1855.51**
T-26	Breach (Southern Breach)	Rip Rap	120	tons	trucks	22	6		9	60	540	0.15676	0.71434	4.67232	0.15530	0.08842	1558.59333	**0.19**	**0.85**	**5.56**	**0.18**	**0.11**	**1855.51**

Option B: Imported by barges and loaded/unloaded by dump-trucks at Project site and Quarry site

Table 7-2-B Option B Emissions Part 1 - from dump trucks at the quarry and project site

Assumption: 1 barge is used, and 1 trip per day to transport a full load (4000 tons) materials from the quarry to the Project site, 4 hours of barge operation, and the remaining hours is for dump trucks to load and unload

Emissions from dump trucks			Emission Rate (pounds/hour)						Maximum Daily Emissions Barge and Trucks combined (pounds)					
Task #	**Method**	**Operation Hours**	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01,04,08,09,10, and 22	Barge	4	1.11211	5.74945	25.34137	0.65353	0.65353	3057.06034	4.45	23.00	101.37	2.61	2.61	12228.24
	Dump Trucks	40	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	2.93	15.55	30.15	1.10	1.01	5135.21
	Maximum Daily Emissions from Barge + Trucks								7.38	38.55	131.52	3.71	3.63	17363.45
T-25 and 26	Dump Trucks	40	0.07328	0.38869	0.75378	0.02751	0.02531	128.38031	2.93	15.55	30.15	1.10	1.01	5135.21
	Emissions from Dum Trucks only (rip rap has been imported in the first year								2.93	15.55	30.15	1.10	1.01	5135.21

Table 7-3: Emissions for Deliveries of All Materials (combine the emissions from tables above)

						Total Emissions (pounds) for Option A (import riprap etc by trucks)						Total Emissions (pounds) for Option B (import riprap etc by barges and trucks)						
Task #	**Tasks**	**Start**	**End**	**Year**	**Materials**	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	
T-01	South Property Levee Repair	5/9/2018	6/5/2018	2018	Geotextile	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90	
					Sheet Piles	0.38	1.72	17.07	0.40	0.23	4161.91	0.38	1.72	17.07	0.40	0.23	4161.91	
					Rip Rap	0.14	0.62	6.17	0.14	0.08	1504.31	7.38	38.55	131.52	3.71	3.63	17363.45	
					Fill Material	0.39	1.78	17.63	0.41	0.24	4298.02							
					Max Daily	**0.93**	**4.22**	**41.75**	**0.98**	**0.56**	**10179.14**	**7.78**	**40.36**	**149.47**	**4.13**	**3.87**	**21740.27**	
T-02	Plug existing culvert	5/9/2018	5/11/2018	2018	Concrete	0.10	0.45	4.41	0.10	0.06	1074.50	0.10	0.45	4.41	0.10	0.06	1074.50	
					Max Daily	**0.10**	**0.45**	**4.41**	**0.10**	**0.06**	**1074.50**	**0.10**	**0.45**	**4.41**	**0.10**	**0.06**	**1074.50**	
T-04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	Sheet Piles	0.33	1.48	14.63	0.34	0.20	3567.35	0.33	1.48	14.63	0.34	0.20	3567.35	
					Pump Fuel	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90	
					Fill Material	0.24	1.07	10.58	0.25	0.14	2578.81	7.38	38.55	131.52	3.71	3.63	17363.45	17363.45
					Max Daily	**0.58**	**2.64**	**26.09**	**0.61**	**0.35**	**6361.07**	**7.73**	**40.11**	**147.03**	**4.08**	**3.83**	**21145.71**	
T-05	Maintenance Dewatering (Groundwater)	9/11/2018	11/4/2019	2018-2019	Pump Fuel	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90	
					Total	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	
T-08	Construct Ramps	8/28/2018	9/24/2018	2018	Fill Material	0.99	4.45	44.07	1.03	0.59	10745.04	7.38	38.55	131.52	3.71	3.63	17363.45	
					Aggregate Base	0.26	1.16	11.46	0.27	0.15	2793.71							
					Max Daily	**1.24**	**5.61**	**55.53**	**1.30**	**0.74**	**13538.76**	**7.38**	**38.55**	**131.52**	**3.71**	**3.63**	**17363.45**	
T-09	Construct Access Roads	8/28/2018	12/7/2018	2018	Geotextile	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90	
					Rip Rap	0.49	2.23	22.03	0.52	0.29	5372.52	7.38	38.55	131.52	3.71	3.63	17363.45	
					Fill Material	1.48	6.68	66.10	1.55	0.88	16117.57							
					Aggregate Base	1.48	6.68	66.10	1.55	0.88	16117.57							
					Max Daily	**1.99**	**8.99**	**89.02**	**2.08**	**1.19**	**21704.99**	**7.40**	**38.63**	**132.40**	**3.74**	**3.64**	**17578.35**	
T-10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	Aggregate Base	1.78	8.01	79.32	1.86	1.06	19341.08	7.38	38.55	131.52	3.71	3.63	17363.45	
					Max Daily	**1.78**	**8.01**	**79.32**	**1.86**	**1.06**	**19341.08**	**7.38**	**38.55**	**131.52**	**3.71**	**3.63**	**17363.45**	
T-16	Remove existing Pump (Southeast corner)	10/27/2020	11/24/2020	2019	Concrete	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**	
					Max Daily	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**	**0.06**	**0.27**	**2.33**	**0.06**	**0.04**	**633.54**	
T-22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	Aggregate Base	0.41	1.89	12.36	0.41	0.23	4123.35	7.38	38.55	131.52	3.71	3.63	17363.45	17363.45
					Max Daily	**0.41**	**1.89**	**12.36**	**0.41**	**0.23**	**4123.35**	**7.38**	**38.55**	**131.52**	**3.71**	**3.63**	**17363.45**	
					Rip Rap	0.19	0.85	5.56	0.18	0.11	1855.51	2.93	15.55	30.15	1.10	1.01	5135.21	
					Max Daily	**0.19**	**0.85**	**5.56**	**0.18**	**0.11**	**1855.51**	**2.93**	**15.55**	**30.15**	**1.10**	**1.01**	**5135.21**	
					Rip Rap	0.19	0.85	5.56	0.18	0.11	1855.51	2.93	15.55	30.15	1.10	1.01	5135.21	
					Max Daily	**0.19**	**0.85**	**5.56**	**0.18**	**0.11**	**1855.51**	**2.93**	**15.55**	**30.15**	**1.10**	**1.01**	**5135.21**	
T-27	Planting and revegetation	7/2/2020	9/23/2020	2020	Plants	0.10	0.47	3.09	0.10	0.06	1030.84	0.10	0.47	3.09	0.10	0.06	1030.84	
					Max Daily	**0.10**	**0.47**	**3.09**	**0.10**	**0.06**	**1030.84**	**0.10**	**0.47**	**3.09**	**0.10**	**0.06**	**1030.84**	

Table 7-4: Summary of Maximum Daily Emissions from Material Deliveries for Each Task

		Total Emissions (pounds) for Option A (import riprap etc by trucks)						Total Emissions (pounds) for Option B (import riprap etc by barges and trucks)					
Task #	Task	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
T-01	South Property Levee Repair	0.93	4.22	41.75	0.98	0.56	10179.14	7.78	40.36	149.47	4.13	3.87	21740.27
T-02	Plug existing culvert	0.10	0.45	4.41	0.10	0.06	1074.50	0.10	0.45	4.41	0.10	0.06	1074.50
T-04	Initial Dewatering (Surface Water)	0.58	2.64	26.09	0.61	0.35	6361.07	7.73	40.11	147.03	4.08	3.83	21145.71
T-05	Maintenance Dewatering (Groundwater)	0.02	0.09	0.88	0.02	0.01	214.90	0.02	0.09	0.88	0.02	0.01	214.90
T-08	Construct Ramps	1.24	5.61	55.53	1.30	0.74	13538.76	7.38	38.55	131.52	3.71	3.63	17363.45
T-09	Construct Access Roads	1.99	8.99	89.02	2.08	1.19	21704.99	7.40	38.63	132.40	3.74	3.64	17578.35
T-10	Interior Staging Area Construction	1.78	8.01	79.32	1.86	1.06	19341.08	7.38	38.55	131.52	3.71	3.63	17363.45
T-16	Remove existing Pump (Southeast corner)	0.06	0.27	2.33	0.06	0.04	633.54	0.06	0.27	2.33	0.06	0.04	633.54
T-22	Dredge Miner Slough	0.41	1.89	12.36	0.41	0.23	4123.35	7.38	38.55	131.52	3.71	3.63	17363.45
T-25	Breach (Northern Breach)	0.19	0.85	5.56	0.18	0.11	1855.51	2.93	15.55	30.15	1.10	1.01	5135.21
T-26	Breach (Southern Breach)	0.19	0.85	5.56	0.18	0.11	1855.51	2.93	15.55	30.15	1.10	1.01	5135.21
T-27	Planting and revegetation	0.10	0.47	3.09	0.10	0.06	1030.84	0.10	0.47	3.09	0.10	0.06	1030.84

Table 8 Fugitive Dust Emissions

	Tasks	Total Acres	Num Work Days	Total Acres/Num Workdays	Average Daily Acres	Max Daily Acres	Emissions Factor (pounds/acre-day)		Maximum Daily Emissions (pounds/day)		Emissions for the Task (pound)	
							PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
T-01	South Property Levee Repair	0.6	15	0.04	0.10	0.1	10.00	2.08	1.00	0.21	15.00	3.12
T-02	Plug Existing Culvert						10.00	2.08	0.00	0.00	0.00	0.00
T-03	Terrestrial Species control						10.00	2.08	0.00	0.00	0.00	0.00
T-04	Initial Dewatering (Surface Water)	62	16	3.88	4.00	5.0	5.00	1.04	25.00	5.20	320.00	66.56
T-05	Maintenance Dewatering (Groundwater)						10.00	2.08	0.00	0.00	0.00	0.00
T-06	Aquatic Species control						10.00	2.08	0.00	0.00	0.00	0.00
T-07	Clearing and Grubbing						10.00	2.08	40.00	8.32	3255.00	677.04
T-08	Construct Ramps	2	10	0.20	0.50	1.0	10.00	2.08	10.00	2.08	50.00	10.40
T-09	Construct Access Roads	16.1	44	0.37	0.50	1.0	10.00	2.08	10.00	2.08	220.00	45.76
T-10	Interior Staging Area Construction						10.00	2.08	0.00	0.00	0.00	0.00
T-11	Old infrastructure removal						10.00	2.08	0.00	0.00	0.00	0.00
T-12	Remove Pump Stations (6)	0.25	3	0.08	0.25	0.25	10.00	2.08	2.50	0.52	7.50	1.56
T-13	Breach (Cross Levee)	2	20	0.10	0.50	1.0	10.00	2.08	10.00	2.08	100.00	20.80
T-14	Interior Channel Network	59.4	79	0.75	1.00	2.0	10.00	2.08	20.00	4.16	790.00	164.32
T-15	Dry Excavated Material						10.00	2.08	0.00	0.00	0.00	0.00
T-16	Remove existing Pump (Southeast corner)						10.00	2.08	0.00	0.00	0.00	0.00
T-17	Fill Agricultural Ditches	2	4	0.50	1.00	1.0	10.00	2.08	10.00	2.08	40.00	8.32
T-18	Construct Interior Mounds	3	18	0.17	0.50	1.0	10.00	2.08	10.00	2.08	90.00	18.72
T-19	Construct Eastern Toe Berm	18.5	77	0.24	0.50	1.0	10.00	2.08	10.00	2.08	385.00	80.08
T-20	Construct Intertidal Bench	66.5	107	0.62	1.00	2.0	10.00	2.08	20.00	4.16	1070.00	222.56
T-21	Fill borrow ditch	3	3	1.00	1.50	2.0	10.00	2.08	20.00	4.16	45.00	9.36
T-22	Dredge Miner Slough	18	30	0.60	1.00	2.0	10.00	2.08	20.00	4.16	300.00	62.40
T-23	Remove Access Roads	0.3	23	0.01	0.30	0.30	10.00	2.08	3.00	0.62	69.00	14.35
T-24	Remove Ramps	0.3	8	0.04	0.30	0.30	10.00	2.08	3.00	0.62	24.00	4.99
T-25	Breach (Northern Breach)	1.5	22	0.07	0.50	1.5	10.00	2.08	15.00	3.12	110.00	22.88
T-26	Breach (Southern Breach)	1.5	22	0.07	0.50	1.5	10.00	2.08	15.00	3.12	110.00	22.88
T-27	Planting and revegetation			0.00			10.00	2.08	0.00	0.00	0.00	0.00
	Clearing and Grubbing	156	93	1.68	2.00	2.5	10.00	2.08	25.00	5.20	1860.00	386.88
T-07	Clearing and Disking	504	93	5.42	6.00	6.0	2.50	0.52	15.00	3.12	1395.00	290.16
	Total								40.00	8.32	3255.00	677.04

Notes
1. Column D is the total acres disturbed
2. Column E is the number of workdays for the soil disturbance operation
3. Column F is the total acres devided by Column E.
4. Column G is the average number of acres disturbed each day. The values in this column are determined on the case by case basis depending on the type of operation.
5. Column H is the maximum of number of acres disturbed on a single day based on the worst case senario. It is estimated on the case by case basis.
For site prepration operations, the areas only need to be disturbed one or two pass, so the values in Column G and H would be smaller; For construction activities, construction equipment would disturb the areas multiple times, so more acres would be disturbed on daily basis.
6. Comumns I and J are emissions factors for fugitive dust, which are taken from the Roadway Construction Model, Version 7.1.5.1.The emission factor values are accepted by the California Air Resources Board for project with dewatering.
(http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-7.pdf). It is also used by URBEMIS2007 model.
Clearing and disking operation in T-07 involves the remove and disk trees which not occupy the whole area, so a 75% reduction of emission factors is used.
Clearing existing ditches in T-04 involve working on wet surfaces, and a 50% reduction to the emission factors is used.
7. Columns K and L are the maximum daily emissions. K = G * H and L = J x H.
8. Columns M and N are the total emissions for the task. M = G x E x I; N = G x E x I.

Table 9-01 through 9-27 Task Emissions (Off-road Equipment, On-road Vehicles, Worker Commute and Helicopter etc)

Table 9 -01 Emissions from Task 02- South Property Levee Repair

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor	2	0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.86	9.59	10.36	0.40	0.37	1776.59	240	12.86	143.88	155.47	5.97	5.50	26648.89
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	2	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	1.45	7.06	14.61	0.81	0.75	1302.91	240	21.72	105.90	219.13	12.17	11.20	19543.60
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.53	7.31	5.91	0.19	0.18	1502.25	40	2.63	36.57	29.53	0.96	0.88	7511.24
	Telescopic Handler (Forklift)	1	0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.22	1.43	2.23	0.12	0.11	263.05	37	1.04	6.63	10.30	0.56	0.52	1216.62
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	2	0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	1.07	7.31	14.05	0.46	0.42	1407.79	240	16.08	109.58	210.68	6.85	6.30	21116.85
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton	1	0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.53	3.58	6.35	0.26	0.24	717.53	72	4.77	32.25	57.17	2.31	2.12	6457.78
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator	1	0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.42	1.88	1.98	0.12	0.11	248.25	56	2.95	13.16	13.83	0.85	0.78	1737.75
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461														
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	60	0.21	2.37	0.26	0.08	0.03	734.86
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	148	0.51	5.84	0.64	0.19	0.08	1812.66
	Water Truck	1	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.01	0.06	0.59	0.01	0.01	143.14	60	0.10	0.44	4.40	0.10	0.06	1073.53
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00	14	0.06	0.26	2.57	0.06	0.03	626.23
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
										0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions (note 2)		13	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.23	2.60	0.28	0.08	0.03	768.09	151	2.67	30.16	3.25	0.94	0.39	8914.33
Sub Total										5.38	41.46	56.42	2.47	2.22	8325.57		65.59	487.02	707.23	31.04	27.90	97394.34

Table 9 -02 Emissions from Task 02- Plug Existing Culvert

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton	1	0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.50	2.03	5.06	0.27	0.25	405.72	8	0.50	2.03	5.06	0.27	0.25	405.72
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator	1	0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.09	0.47	0.62	0.03	0.03	74.10	16	0.18	0.94	1.25	0.06	0.06	148.21
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck	1	0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.71	6.24	8.10	0.31	0.28	1197.65	4	0.36	3.12	4.05	0.15	0.14	598.83
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON	1	0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.59	3.11	6.03	0.22	0.20	1027.04	2	0.15	0.78	1.51	0.06	0.05	256.76
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	12	0.04	0.47	0.05	0.02	0.01	146.97
	Pickup 4x4 3/4 TON		0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.00	0.00	0.00	0.00	0.00	0.00	120	0.41	4.73	0.52	0.15	0.07	1469.73
	Water Truck		0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck	1	0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.03	0.15	1.47	0.03	0.02	357.84	16	0.07	0.30	2.94	0.07	0.04	715.69
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		6	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.11	1.20	0.13	0.04	0.02	354.51	22	0.39	4.45	0.48	0.14	0.06	1314.62
Sub Total										2.06	13.51	21.45	0.91	0.80	3514.85		2.10	16.81	15.85	0.92	0.67	5056.52

Table 9 - 03 Emissions from Task 03 - Terrestrial Species Control

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	108	0.37	4.26	0.47	0.14	0.06	1322.75
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	160	0.55	6.31	0.69	0.21	0.09	1959.63
	Water Truck		0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		2	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.04	0.40	0.04	0.01	0.01	118.17	34	0.59	6.70	0.72	0.21	0.09	1979.32
Sub Total										0.09	1.03	0.11	0.03	0.01	314.13		1.51	17.27	1.88	0.55	0.23	5261.71

Table 9 - 04

Emissions from Task 04 - Initial Dewatering (Surface Water)

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"	2	0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.54	5.52	6.23	0.29	0.27	1022.96	56	1.90	19.33	21.79	1.01	0.93	3580.36
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	1	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.72	3.53	7.30	0.41	0.37	651.45	16	1.45	7.06	14.61	0.81	0.75	1302.91
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	3	0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	1.58	21.94	17.72	0.57	0.53	4506.74	512	33.69	468.08	377.97	12.24	11.26	96143.89
	Telescopic Handler (Forklift)	1	0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.22	1.43	2.23	0.12	0.11	263.05	80	2.25	14.33	22.28	1.21	1.12	2630.52
	950G Rubber Tire Loader	1	0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.50	3.51	5.93	0.20	0.18	746.33	28	1.75	12.28	20.74	0.70	0.65	2612.16
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton	1	0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.50	2.03	5.06	0.27	0.25	405.72	80	5.02	20.26	50.60	2.71	2.49	4057.16
	RT Crane 60 Ton	2	0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	1.06	7.17	12.70	0.51	0.47	1435.06	352	23.34	157.66	279.50	11.28	10.37	31571.36
	Small Generator	1	0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.09	0.47	0.62	0.03	0.03	74.10	20	0.22	1.17	1.56	0.08	0.07	185.26
	Large Generator	6	0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	24	7.59	33.84	35.57	2.19	2.01	4468.49	3232	170.32	759.50	798.25	49.05	45.12	100292.74
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON	8	0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	4.69	24.88	48.24	1.76	1.62	8216.34	64	4.69	24.88	48.24	1.76	1.62	8216.34
	Semi End Dump 20 TON	9	0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	8.92	47.29	91.70	3.35	3.08	15618.13	1152	142.64	756.58	1467.21	53.55	49.27	249890.07
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	120	0.41	4.73	0.52	0.15	0.07	1469.73
	Pickup 4x4 3/4 TON		0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.00	0.00	0.00	0.00	0.00	0.00	64	0.22	2.52	0.28	0.08	0.03	783.85
	Water Truck		0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck	1	0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.03	0.15	1.47	0.03	0.02	357.84	544	2.23	10.08	99.80	2.34	1.33	24333.44
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		37	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.66	7.40	0.80	0.23	0.10	2186.12	790	13.99	157.90	17.00	4.90	2.06	46676.51
Sub Total										27.13	159.46	235.60	9.97	9.04	40050.32		404.13	2416.37	3220.34	141.88	127.15	573746.30

Table 9 - 05

Emissions from Task 05 - Maintenance Dewatering (Groundwater)

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.53	7.31	5.91	0.19	0.18	1502.25	80	5.26	73.14	59.06	1.91	1.76	15022.48
	Telescopic Handler (Forklift)	1	0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.22	1.43	2.23	0.12	0.11	263.05	960	26.98	172.01	267.35	14.56	13.39	31566.24
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton	1	0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.50	2.03	5.06	0.27	0.25	405.72	1020	63.96	258.32	645.13	34.54	31.78	51728.76
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator	1	0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.09	0.47	0.62	0.03	0.03	74.10	240	2.69	14.03	18.69	0.96	0.88	2223.13
	Large Generator	8	0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	3.37	15.04	15.81	0.97	0.89	1985.99	8960	472.17	2105.56	2212.98	135.97	125.10	278039.29
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig	1	0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.30	3.79	3.93	0.11	0.10	942.54	240	8.85	113.60	117.82	3.33	3.06	28276.19
	10 Wheel Dump 10 TON	2	0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	1.17	6.22	12.06	0.44	0.40	2054.09	160	11.73	62.19	120.60	4.40	4.05	20540.85
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	40	0.14	1.58	0.17	0.05	0.02	489.91
	Water Truck		0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck	1	0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.03	0.15	1.47	0.03	0.02	357.84	1420	5.83	26.32	260.50	6.10	3.48	63517.43
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		17	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.30	3.40	0.37	0.11	0.04	1004.43	1640	29.05	327.79	35.28	10.17	4.28	96898.07
Sub Total										6.54	40.15	47.48	2.29	2.04	8688.00		626.66	3154.54	3737.60	212.00	187.81	588302.36

Table 9 - 06

Emissions from Task 06 - Aquatic Species control

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

Emission Sources		Source Quantities	ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	32	0.11	1.26	0.14	0.04	0.02	391.93
	Pickup 4x4 3/4 TON		0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Water Truck		0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Helicopter for Herbicide Spraying		1	6.1125	7.7642	3.9282	0.1220	0.1220	1993.0133	8	48.90	62.11	31.43	0.98	0.98	15944.11	8	48.90	62.11	31.43	0.98	0.98	15944.11
Worker Commute Emissions		2	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.04	0.40	0.04	0.01	0.01	118.17	5	0.09	1.00	0.11	0.03	0.01	295.42
Sub Total										48.96	62.83	31.50	1.00	0.99	16160.26		49.10	64.38	31.67	1.05	1.01	16631.45

Table 9 - 07

Emissions from Task 07 - Clearing and Grubbing

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	7	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	5.07	24.71	51.13	2.84	2.61	4560.17	4750	429.93	2095.88	4336.96	240.92	221.65	386800.49
	LGP 325L Excavator	2	0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.65	5.76	6.61	0.32	0.29	1183.12	744	30.05	267.84	307.39	14.91	13.72	55015.11
	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader	1	0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.50	3.51	5.93	0.20	0.18	746.33	744	46.56	326.30	551.14	18.69	17.20	69408.92
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder	1	0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.76	6.62	8.59	0.33	0.30	1270.24	290	27.37	240.04	311.47	11.80	10.85	46046.09
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	2	0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	1.98	10.51	20.38	0.74	0.68	3470.70	1034	128.03	679.08	1316.93	48.07	44.22	224293.69
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	372	1.27	14.68	1.61	0.48	0.20	4556.15
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	186	0.64	7.34	0.80	0.24	0.10	2278.08
	Water Truck	2	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.03	0.12	1.17	0.03	0.02	286.28	1488	2.44	11.03	109.19	2.56	1.46	26623.64
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		17	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.30	3.40	0.37	0.11	0.04	1004.43	1201	21.28	240.05	25.84	7.45	3.14	70960.11
Sub Total										9.33	55.26	94.25	4.58	4.15	12717.23		687.57	3882.24	6961.33	345.11	312.53	885982.30

Table 9 - 08

Emissions from Task 08 - Construct Ramps

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"	2	0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.54	5.52	6.23	0.29	0.27	1022.96	184	6.25	63.51	71.60	3.31	3.05	11764.05
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	2	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	1.45	7.06	14.61	0.81	0.75	1302.91	192	17.38	84.72	175.30	9.74	8.96	15634.88
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader	1	0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.50	3.51	5.93	0.20	0.18	746.33	48	3.00	21.05	35.56	1.21	1.11	4478.00
	140H Motor Grader	2	0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	1.07	7.31	14.05	0.46	0.42	1407.79	160	10.72	73.05	140.45	4.57	4.20	14077.90
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	32	0.11	1.26	0.14	0.04	0.02	391.93
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	20	0.07	0.79	0.09	0.03	0.01	244.95
	Water Truck	2	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.03	0.12	1.17	0.03	0.02	286.28	80	0.13	0.59	5.87	0.14	0.08	1431.38
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		11	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.19	2.20	0.24	0.07	0.03	649.93	90	1.59	17.89	1.93	0.56	0.23	5288.04
Sub Total										3.84	26.34	42.29	1.87	1.67	5612.16		39.24	262.87	430.93	19.58	17.66	53311.12

Table 9 - 09 Emissions from Task 09 - Construct Access Roads

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)						hours	Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"	2	0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.54	5.52	6.23	0.29	0.27	1022.96	776	26.35	267.86	301.95	13.97	12.86	49613.60
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	2	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	1.45	7.06	14.61	0.81	0.75	1302.91	848	76.75	374.17	774.26	43.01	39.57	69054.07
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)	1	0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.22	1.43	2.23	0.12	0.11	263.05	16	0.45	2.87	4.46	0.24	0.22	526.10
	950G Rubber Tire Loader	1	0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.50	3.51	5.93	0.20	0.18	746.33	144	9.01	63.15	106.67	3.62	3.33	13433.99
	140H Motor Grader	2	0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	1.07	7.31	14.05	0.46	0.42	1407.79	704	47.16	321.42	617.99	20.09	18.48	61942.77
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton	1	0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.53	3.58	6.35	0.26	0.24	717.53	16	1.06	7.17	12.70	0.51	0.47	1435.06
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	128	0.44	5.05	0.55	0.17	0.07	1567.71
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	96	0.33	3.79	0.41	0.12	0.05	1175.78
	Water Truck	2	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.03	0.12	1.17	0.03	0.02	286.28	352	0.58	2.61	25.83	0.60	0.35	6298.07
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		13	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.23	2.60	0.28	0.08	0.03	768.09	385	6.82	76.95	8.28	2.39	1.01	22747.41
Sub Total										4.63	31.76	50.91	2.26	2.02	6710.91		168.95	1125.04	1853.11	84.73	76.40	227794.55

Table 9 - 10 Emissions from Task 10 - Interior Staging Area Construction

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)						hours	Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"	2	0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.54	5.52	6.23	0.29	0.27	1022.96	288	9.78	99.41	112.06	5.19	4.77	18413.29
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	2	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	1.45	7.06	14.61	0.81	0.75	1302.91	288	26.07	127.08	262.96	14.61	13.44	23452.32
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	2	0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	1.07	7.31	14.05	0.46	0.42	1407.79	288	19.29	131.49	252.81	8.22	7.56	25340.22
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	36	0.12	1.42	0.16	0.05	0.02	440.92
	Pickup 4x4 3/4 TON		0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Water Truck	2	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.03	0.12	1.17	0.03	0.02	286.28	144	0.24	1.07	10.57	0.25	0.14	2576.48
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		9	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.16	1.80	0.19	0.06	0.02	531.76	131	2.31	26.08	2.81	0.81	0.34	7710.49
Sub Total										3.28	22.12	36.28	1.65	1.48	4649.67		57.81	386.55	641.36	29.12	26.27	77933.73

Table 9 - 11 Emissions from Task 11 - Old infrastructure rem

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)						hours	Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	1	0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.72	3.53	7.30	0.41	0.37	651.45	40	3.62	17.65	36.52	2.03	1.87	3257.27
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.53	7.31	5.91	0.19	0.18	1502.25	40	2.63	36.57	29.53	0.96	0.88	7511.24
	Telescopic Handler (Forklift)		0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

	Semi End Dump 20 TON		0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	10	0.03	0.39	0.04	0.01	0.01	122.48
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	20	0.07	0.79	0.09	0.03	0.01	244.95
	Water Truck		0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		4	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.07	0.80	0.09	0.02	0.01	236.34	14	0.24	2.75	0.30	0.09	0.04	812.41
Sub Total										1.38	12.27	13.37	0.64	0.57	2586.00		6.60	58.15	66.48	3.11	2.80	11948.35

Table 9 - 12

Emissions from Task 12 - Remove Pump Station

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.053567	0.599483	0.647782	0.024895	0.022904	111.037026	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.033951	0.345182	0.389106	0.018009	0.016568	63.935050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.090511	0.441238	0.913044	0.050721	0.046663	81.431682	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.040386	0.360004	0.413164	0.020038	0.018435	73.945044	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.065802	0.914218	0.738222	0.023911	0.021998	187.781032	8	0.53	7.31	5.91	0.19	0.18	1502.25	24	1.58	21.94	17.72	0.57	0.53	4506.74
	Telescopic Handler (Forklift)	1	0.028109	0.179179	0.278495	0.015164	0.013951	32.881502	8	0.22	1.43	2.23	0.12	0.11	263.05	55	1.55	9.85	15.32	0.83	0.77	1808.48
	950G Rubber Tire Loader		0.062581	0.438572	0.740773	0.025124	0.023114	93.291565	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.066988	0.456564	0.877827	0.028536	0.026254	87.986885	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton	1	0.062706	0.253251	0.632484	0.033867	0.031158	50.714470	8	0.50	2.03	5.06	0.27	0.25	405.72	40	2.51	10.13	25.30	1.35	1.25	2028.58
	RT Crane 60 Ton	1	0.066301	0.447889	0.794032	0.032037	0.029474	89.691369	8	0.53	3.58	6.35	0.26	0.24	717.53	40	2.65	17.92	31.76	1.28	1.18	3587.65
	Small Generator	1	0.011204	0.058470	0.077875	0.003990	0.003671	9.263039	8	0.09	0.47	0.62	0.03	0.03	74.10	10	0.11	0.58	0.78	0.04	0.04	92.63
	Large Generator	1	0.052697	0.234995	0.246984	0.015176	0.013962	31.031171	8	0.42	1.88	1.98	0.12	0.11	248.25	40	2.11	9.40	9.88	0.61	0.56	1241.25
	Concrete Crane Pump Truck		0.088993	0.780438	1.012672	0.038355	0.035287	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.094387	0.827737	1.074046	0.040680	0.037426	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.036881	0.473327	0.490917	0.013872	0.012762	117.817478	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.073282	0.388690	0.753777	0.027513	0.025312	128.380314	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	3	0.123822	0.656752	1.273623	0.046487	0.042768	216.918461	8	2.97	15.76	30.57	1.12	1.03	5206.04	72	8.92	47.29	91.70	3.35	3.08	15618.13
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	52	0.18	2.05	0.22	0.07	0.03	636.88
	Pickup 4x4 3/4 TON	1	0.003424	0.039450	0.004319	0.001290	0.000542	12.247718	8	0.03	0.32	0.03	0.01	0.00	97.98	12	0.04	0.47	0.05	0.02	0.01	146.97
	Water Truck	1	0.001642	0.007415	0.073380	0.001717	0.000980	17.892234	8	0.01	0.06	0.59	0.01	0.01	143.14	24	0.04	0.18	1.76	0.04	0.02	429.41
	Service Truck	1	0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.03	0.15	1.47	0.03	0.02	357.84	20	0.08	0.37	3.67	0.09	0.05	894.61
	Flatbed 2 TON		0.004106	0.018536	0.183451	0.004294	0.002451	44.730584	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		13	0.017715	0.199875	0.021515	0.006202	0.002612	59.084192	1	0.23	2.60	0.28	0.08	0.03	768.09	49	0.86	9.72	1.05	0.30	0.13	2872.97
Sub Total										5.60	35.90	55.12	2.26	2.01	9881.98		20.62	129.90	199.21	8.55	7.63	33864.32

Note

1. Off-Road and On-Road Construction Vehicle emissions, Column D is the maximum number of pieces of construction equipment on a day, Column R is the total number of hours for that type of equipment.
Column K contains hours of operation for that type of construction equipment.
Data for Columns D and K are obtained from datasheets provided by Engineers from DOE.
Columns E - J are hourly emission rates from Tables 5A-5F.
Daily Emissions (Columns L -Q) are the maximum daily emissions from that type of equipment, by assuming all construction vehicles for that task are in operation on the same day, the values are Columns E-J multiply Column D and K
Task Emissions (Columns S -X) are the total emissions from that type of equipment for that task, the values are Columns E-J multiply Column R
2. Emissions generated by the helicopter for spraying herbicide in Task 06 Aquatic Species control are calculated the same way as construction vehicles.
Columns E - J, the hourly emission rates for the helicopter are from Tables 5-E on the UnitEmissionRates tab.
3. Worker Commute Emissions, Column D is the maximum number of workers for that task, and Colomn R is the total worker days for that task.
Column D is the maximum workers are based on the number of pieces of construction vehicles for that task.
Colunm R is the worker days for that task, estimated by number of pieces of equipment and number of worker days.
Columns E - J are daily worker commute emissions from Tables 3-C on the UnitEmissionRates tab.
Daily Emissions (Columns L -Q) are obtained by multiply emissions of one worker commute (Columns E-J) with number of workers (Column D) and K (no meaning, set to 1)
Task Emissions (Columns S -X) are the total emissions from worker commute trips for that task, obtained by multiplying Columns E-J with Column R

Table 9 - 13 Emissions from Task 13 - Breach (Cross Levee)

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle) ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	Daily Emissions (pounds per day) ROG	CO	NOx	PM10	PM2.5	CO2	hours	Emissions for the Task ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	2	0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.98	14.63	10.25	0.33	0.31	3004.37	320	19.54	292.54	205.06	6.66	6.13	60087.45
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	6	0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	5.46	31.51	52.80	1.92	1.77	10407.68	960	109.12	630.22	1055.92	38.40	35.33	208153.57
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	80	0.25	2.91	0.31	0.10	0.04	975.10
	Pickup 4x4 3/4 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	80	0.25	2.91	0.31	0.10	0.04	975.10
	Water Truck	1	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.01	0.06	0.52	0.01	0.01	140.66	160	0.27	1.22	10.36	0.27	0.16	2813.20
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
										0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		11	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.18	2.03	0.21	0.07	0.03	646.82	200	3.30	36.85	3.91	1.24	0.52	11760.35
		Sub Total								6.68	48.81	63.84	2.36	2.12	14394.55		132.74	966.65	1275.87	46.78	42.22	284764.79

Table 9 - 14 Emissions from Task 14 - Interior Channel Network

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle) ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	Daily Emissions (pounds per day) ROG	CO	NOx	PM10	PM2.5	CO2	hours	Emissions for the Task ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	6	0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	2.93	43.88	30.76	1.00	0.92	9013.12	5136	313.69	4695.23	3291.16	106.87	98.32	964403.55
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	18	0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	16.37	94.53	158.39	5.76	5.30	31223.04	15408	1751.39	10114.95	16947.50	616.29	566.99	3340864.78
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	316	1.01	11.50	1.24	0.41	0.17	3851.66
	Pickup 4x4 3/4 TON	2	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.05	0.58	0.06	0.02	0.01	195.02	540	1.72	19.65	2.12	0.70	0.29	6581.96
	Water Truck	3	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.04	0.18	1.55	0.04	0.02	421.98	1712	2.88	13.05	110.80	2.94	1.68	30101.29
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		30	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.49	5.53	0.59	0.19	0.08	1764.05	2889	47.60	532.36	56.43	17.90	7.53	169878.32
		Sub Total								19.91	145.00	191.38	7.02	6.33	42714.72		2118.28	15386.75	20409.25	745.10	674.98	4515681.55

Table 9 - 15 Emissions from Task 15 - Dry Excavated Material

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle) ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	Daily Emissions (pounds per day) ROG	CO	NOx	PM10	PM2.5	CO2	hours	Emissions for the Task ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	3	0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	2.02	10.58	20.13	1.12	1.03	1952.26	2352	198.30	1036.68	1972.68	109.82	101.03	191321.91
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	3	0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	1.51	10.93	19.45	0.62	0.57	2106.69	2352	147.56	1071.30	1905.93	61.17	56.28	206455.23
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	784	2.50	28.54	3.08	1.01	0.42	9556.03
	Water Truck	1	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.01	0.06	0.52	0.01	0.01	140.66	392	0.66	2.99	25.37	0.67	0.38	6892.35
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		8	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.13	1.47	0.16	0.05	0.02	470.41	735	12.11	135.44	14.36	4.55	1.92	43219.30
Sub Total										3.70	23.34	40.28	1.82	1.64	4767.54		361.13	2274.94	3921.41	177.22	160.03	457444.83

Table 9 - 16 Emissions from Task 16 - Remove existing Pump (Southeast corner)

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)						hours	Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)	1	0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.20	1.43	1.94	0.11	0.10	263.05	16	0.40	2.87	3.89	0.21	0.19	526.10
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton	1	0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.46	2.03	4.59	0.25	0.23	405.75	32	1.83	8.10	18.36	0.98	0.90	1623.02
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator	1	0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.09	0.47	0.61	0.03	0.03	74.10	16	0.17	0.93	1.22	0.06	0.06	148.21
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00	8	0.70	6.24	7.75	0.29	0.27	1197.65
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON	1	0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.54	3.11	5.21	0.19	0.17	1026.61	32	2.15	12.43	20.83	0.76	0.70	4106.43
	Semi End Dump 20 TON		0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	20	0.06	0.73	0.08	0.03	0.01	243.78
	Pickup 4x4 3/4 TON		0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Water Truck		0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck	1	0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.03	0.15	1.29	0.03	0.02	351.65	8	0.03	0.15	1.29	0.03	0.02	351.65
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		6	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.10	1.11	0.12	0.04	0.02	352.81	17	0.27	3.04	0.32	0.10	0.04	970.23
Sub Total										1.44	8.58	13.79	0.65	0.56	2571.49		5.63	34.50	53.74	2.47	2.19	9167.07

Table 9 - 17 Emissions from Task 17 - Fill Agricultural Ditches

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)						hours	Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor	3	0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	1.23	14.39	14.59	0.56	0.51	2664.73	168	8.61	100.71	102.16	3.90	3.58	18653.10
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	3	0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	2.02	10.58	20.13	1.12	1.03	1952.26	168	14.16	74.05	140.91	7.84	7.22	13665.85
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	28	0.09	1.02	0.11	0.04	0.02	341.29
	Water Truck	1	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.01	0.06	0.52	0.01	0.01	140.66	56	0.09	0.43	3.62	0.10	0.05	984.62
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		8	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.13	1.47	0.16	0.05	0.02	470.41	53	0.87	9.67	1.03	0.33	0.14	3087.09
Sub Total										3.42	26.79	35.43	1.75	1.58	5325.58		23.82	185.88	247.83	12.20	11.01	36731.95

Table 9 - 18 Emissions from Task 18 - Construct Interior Mounds

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)						hours	Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2
	815F Sheepfoot Compactor	3	0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	1.23	14.39	14.59	0.56	0.51	2664.73	432	22.13	258.96	262.70	10.02	9.22	47965.10
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

Off-Road Construction Vehicles	Dozer (D-6H Dozer)	3	0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	2.02	10.58	20.13	1.12	1.03	1952.26	432	36.42	190.41	362.33	20.17	18.56	35140.76
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	3	0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	1.51	10.93	19.45	0.62	0.57	2106.69	432	27.10	196.77	350.07	11.24	10.34	37920.35
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	72	0.23	2.62	0.28	0.09	0.04	877.59
	Water Truck	2	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.03	0.12	1.04	0.03	0.02	281.32	288	0.48	2.20	18.64	0.49	0.28	5063.77
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		12	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.20	2.21	0.23	0.07	0.03	705.62	207	3.41	38.14	4.04	1.28	0.54	12171.97
Sub Total										5.01	38.52	55.47	2.41	2.17	7808.13		89.78	689.10	998.07	43.29	38.97	139139.54

Table 9 - 19

Emissions from Task 19 - Construct Eastern Toe Berm

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor	3	0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	1.23	14.39	14.59	0.56	0.51	2664.73	1848	94.68	1107.78	1123.78	42.86	39.43	205184.05
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	3	0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	2.02	10.58	20.13	1.12	1.03	1952.26	1848	155.81	814.53	1549.96	86.28	79.38	150324.36
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	3	0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	1.51	10.93	19.45	0.62	0.57	2106.69	1848	115.94	841.73	1497.52	48.06	44.22	162214.83
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	1	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.03	0.29	0.03	0.01	0.00	97.51	308	0.98	11.21	1.21	0.40	0.17	3754.15
	Water Truck	2	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.03	0.12	1.04	0.03	0.02	281.32	1232	2.07	9.39	79.74	2.11	1.21	21661.67
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		12	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.20	2.21	0.23	0.07	0.03	705.62	886	14.59	163.17	17.30	5.49	2.31	52068.97
Sub Total										5.01	38.52	55.47	2.41	2.17	7808.13		384.07	2947.82	4269.50	185.20	166.71	595208.03

Table 9 - 20

Emissions from Task 20 - Construct Intertidal Bench

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor	6	0.051235	0.599447	0.608108	0.023191	0.021336	111.030330	8	2.46	28.77	29.19	1.11	1.02	5329.46	5136	263.14	3078.76	3123.24	119.11	109.58	570251.77
	RT Sheepfoot 60"		0.029554	0.345280	0.330170	0.015159	0.013946	63.953141	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	6	0.084311	0.440765	0.838724	0.046690	0.042955	81.344350	8	4.05	21.16	40.26	2.24	2.06	3904.53	5136	433.02	2263.77	4307.69	239.80	220.62	417784.58
	LGP 325L Excavator		0.036417	0.359917	0.357912	0.017261	0.015880	73.927125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.061076	0.914181	0.640802	0.020808	0.019143	187.773277	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.025155	0.179179	0.242958	0.013213	0.012156	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.058060	0.438594	0.671416	0.022512	0.020711	93.296359	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	6	0.062738	0.455483	0.810345	0.026007	0.023927	87.778585	8	3.01	21.86	38.90	1.25	1.15	4213.37	5136	322.22	2339.36	4161.93	133.57	122.89	450830.82
	RT Crane 30 Ton		0.057305	0.253275	0.573777	0.030647	0.028195	50.719322	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.062597	0.448006	0.736157	0.029648	0.027277	89.714819	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010929	0.058221	0.076170	0.003800	0.003496	9.263039	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.046855	0.230547	0.240499	0.013700	0.012604	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.087493	0.780438	0.968534	0.036707	0.033770	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.092796	0.827737	1.027233	0.038932	0.035817	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.034211	0.472337	0.431914	0.012249	0.011269	117.571065	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.067273	0.388525	0.650970	0.023672	0.021779	128.325967	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.113668	0.656474	1.099915	0.039998	0.036798	216.826634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	2	0.003187	0.036398	0.003923	0.001289	0.000541	12.188810	8	0.05	0.58	0.06	0.02	0.01	195.02	856	2.73	31.16	3.36	1.10	0.46	10433.62
	Water Truck	3	0.001682	0.007622	0.064722	0.001717	0.000979	17.582528	8	0.04	0.18	1.55	0.04	0.02	421.98	2568	4.32	19.57	166.21	4.41	2.52	45151.93
	Service Truck		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004204	0.019055	0.161805	0.004291	0.002449	43.956320	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

Worker Commute Emissions	23	0.016476	0.184272	0.019532	0.006196	0.002607	58.801773	1	0.38	4.24	0.45	0.14	0.06	1352.44	2354	38.79	433.78	45.98	14.59	6.14	138419.37
Sub Total									9.99	76.80	110.41	4.81	4.33	15416.80		1064.22	8166.39	11808.40	512.58	462.20	1632872.10

Table 9 - 21 Emissions from Task 21 - Fill borrow ditch

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle) ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	Daily Emissions (pounds per day) ROG	CO	NOx	PM10	PM2.5	CO2	hours	Emissions for the Task ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor	2	0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	0.82	9.59	9.46	0.37	0.34	1776.48	48	2.47	28.77	28.38	1.10	1.01	5329.45
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	2	0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	1.24	7.05	12.15	0.68	0.62	1301.13	48	3.73	21.15	36.45	2.04	1.87	3903.39
	LGP 325L Excavator		0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator		0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	2	0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	0.98	7.28	12.46	0.40	0.37	1403.12	48	2.94	21.84	37.39	1.20	1.10	4209.36
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON		0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Pickup 4x4 3/4 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	12	0.04	0.40	0.04	0.02	0.01	146.30
	Water Truck	1	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.01	0.06	0.41	0.01	0.01	137.32	24	0.04	0.19	1.23	0.04	0.02	411.96
	Service Truck		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
										0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		8	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.12	1.36	0.14	0.05	0.02	470.54		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										3.21	25.62	34.66	1.52	1.36	5186.13		9.22	72.36	103.50	4.39	4.01	14000.47

Table 9 - 22 Emissions from Task 22 - Dredge Miner Slough

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle) ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	Daily Emissions (pounds per day) ROG	CO	NOx	PM10	PM2.5	CO2	hours	Emissions for the Task ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor	3	0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	1.23	14.39	14.19	0.55	0.51	2664.73	1040	53.49	623.42	615.00	23.79	21.89	115471.46
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge	1	0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.46	3.58	5.29	0.21	0.20	717.60	240	13.80	107.50	158.83	6.37	5.86	21527.86
	Dozer (D-6H Dozer)	3	0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	1.86	10.58	18.22	1.02	0.94	1951.70	1040	80.76	458.26	789.67	44.12	40.59	84573.49
	LGP 325L Excavator		0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.46	7.31	4.53	0.15	0.14	1500.66	240	13.87	219.18	135.83	4.48	4.12	45019.75
	Telescopic Handler (Forklift)		0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader	3	0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	1.47	10.92	18.70	0.60	0.55	2104.68	1040	63.79	473.25	810.22	25.90	23.83	91202.85
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	6	0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	5.10	31.49	46.43	1.69	1.56	10402.14	1440	152.89	944.82	1392.91	50.75	46.69	312064.25
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	200	0.60	6.74	0.72	0.26	0.11	2438.41
	Pickup 4x4 3/4 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	220	0.66	7.41	0.79	0.28	0.12	2682.25
	Water Truck	2	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.03	0.13	0.82	0.03	0.02	274.64	320	0.55	2.52	16.47	0.55	0.31	5492.84
	Service Truck		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		21	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.33	3.58	0.38	0.13	0.05	1235.17		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										10.99	82.51	108.62	4.40	3.96	21046.38		380.40	2843.11	3920.44	156.49	143.51	680473.16

Table 9 - 23 Emissions from Task 23 - Remove Access Roads

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle) ROG	CO	NOx	PM10	PM2.5	CO2	Hours Per Day	Daily Emissions (pounds per day) ROG	CO	NOx	PM10	PM2.5	CO2	hours	Emissions for the Task ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	1	0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	0.62	3.53	6.07	0.34	0.31	650.57	184	14.29	81.08	139.71	7.81	7.18	14963.00
	LGP 325L Excavator		0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.46	7.31	4.53	0.15	0.14	1500.66	184	10.63	168.04	104.14	3.43	3.16	34515.14
	Telescopic Handler (Forklift)		0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader	1	0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.44	3.51	4.91	0.16	0.15	746.13	184	10.02	80.68	112.87	3.75	3.45	17161.05
	140H Motor Grader		0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00

	Large Generator		0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	8	0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	6.80	41.99	61.91	2.26	2.08	13869.52	1472	156.29	965.82	1423.86	51.88	47.73	318999.01
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	92	0.28	3.10	0.33	0.12	0.05	1121.67
	Pickup 4x4 3/4 TON	2	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.05	0.54	0.06	0.02	0.01	195.07	184	0.55	6.20	0.66	0.24	0.10	2243.34
	Water Truck	1	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.01	0.06	0.41	0.01	0.01	137.32	184	0.32	1.45	9.47	0.31	0.18	3158.38
	Service Truck		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
										0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		15	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.23	2.56	0.27	0.09	0.04	882.27		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										8.63	59.76	78.18	3.04	2.73	18079.07		192.38	1306.35	1791.05	67.53	61.84	392161.59

Table 9 - 24 Emissions from Task 24 - Remove Ramps

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)	1	0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	0.62	3.53	6.07	0.34	0.31	650.57	64	4.97	28.20	48.60	2.71	2.50	5204.52
	LGP 325L Excavator		0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	1	0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.46	7.31	4.53	0.15	0.14	1500.66	64	3.70	58.45	36.22	1.19	1.10	12005.27
	Telescopic Handler (Forklift)		0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader		0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	3	0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	2.55	15.75	23.22	0.85	0.78	5201.07	192	20.39	125.98	185.72	6.77	6.23	41608.57
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	32	0.10	1.08	0.12	0.04	0.02	390.15
	Pickup 4x4 3/4 TON	2	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.05	0.54	0.06	0.02	0.01	195.07	64	0.19	2.16	0.23	0.08	0.03	780.29
	Water Truck	1	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.01	0.06	0.41	0.01	0.01	137.32	64	0.11	0.50	3.29	0.11	0.06	1098.57
	Service Truck		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		9	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.14	1.53	0.16	0.06	0.02	529.36		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										3.86	28.98	34.48	1.43	1.27	8311.58		29.45	216.36	274.18	10.91	9.93	61087.36

Table 9 - 25 Emissions from Task 25 - Breach (Northern Breach)

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	2	0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.92	14.61	9.06	0.30	0.27	3001.32	384	22.19	350.69	217.33	7.16	6.59	72031.60
	Telescopic Handler (Forklift)	1	0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.18	1.43	1.67	0.09	0.08	263.05	48	1.07	8.60	10.02	0.54	0.50	1578.31
	950G Rubber Tire Loader		0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton	1	0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.46	3.58	5.29	0.21	0.20	717.60	128	7.36	57.33	84.71	3.40	3.12	11481.52
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator	1	0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.34	1.82	1.87	0.10	0.09	248.25	128	5.42	29.07	29.98	1.58	1.45	3971.99
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	6	0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	5.10	31.49	46.43	1.69	1.56	10402.14	1056	112.12	692.87	1021.47	37.22	34.24	228847.11
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	74	0.22	2.49	0.27	0.10	0.04	902.21
	Pickup 4x4 3/4 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	176	0.53	5.93	0.63	0.23	0.10	2145.80
	Water Truck	1	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.01	0.06	0.41	0.01	0.01	137.32	176	0.30	1.38	9.06	0.30	0.17	3021.06
	Service Truck	1	0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.03	0.16	1.03	0.03	0.02	343.30	32	0.14	0.63	4.12	0.14	0.08	1373.21
	Flatbed 2 TON	1	0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.03	0.16	1.03	0.03	0.02	343.30	16	0.07	0.31	2.06	0.07	0.04	686.60
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		16	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.25	2.73	0.29	0.10	0.04	941.08		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										7.38	56.58	67.14	2.59	2.30	16592.44		149.43	1149.32	1379.63	50.72	46.32	326039.42

Table 9 - 26 Emissions from Task 26 - Breach (Southern Breach)

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator		0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 375L Excavator	2	0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.92	14.61	9.06	0.30	0.27	3001.32	384	22.19	350.69	217.33	7.16	6.59	72031.60
	Telescopic Handler (Forklift)	1	0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.18	1.43	1.67	0.09	0.08	263.05	48	1.07	8.60	10.02	0.54	0.50	1578.31
	950G Rubber Tire Loader		0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	140H Motor Grader		0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton	1	0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.46	3.58	5.29	0.21	0.20	717.60	128	7.36	57.33	84.71	3.40	3.12	11481.52
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator	1	0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.34	1.82	1.87	0.10	0.09	248.25	128	5.42	29.07	29.98	1.58	1.45	3971.99
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig		0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON	6	0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	5.10	31.49	46.43	1.69	1.56	10402.14	1056	112.12	692.87	1021.47	37.22	34.24	228847.11
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	74	0.22	2.49	0.27	0.10	0.04	902.21
	Pickup 4x4 3/4 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	176	0.53	5.93	0.63	0.23	0.10	2145.80
	Water Truck	1	0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.01	0.06	0.41	0.01	0.01	137.32	176	0.30	1.38	9.06	0.30	0.17	3021.06
	Service Truck	1	0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.03	0.16	1.03	0.03	0.02	343.30	32	0.14	0.63	4.12	0.14	0.08	1373.21
	Flatbed 2 TON	1	0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.03	0.16	1.03	0.03	0.02	343.30	16	0.07	0.31	2.06	0.07	0.04	686.60
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		16	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.25	2.73	0.29	0.10	0.04	941.08		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										7.38	56.58	67.14	2.59	2.30	16592.44		149.43	1149.32	1379.63	50.72	46.32	326039.42

Table 9 - 27 Emissions from Task 27 - Planting and revegetation

Emission Sources		Source Quantities	unit hourly emissions (pounds per day per construction vehicle)						Hours Per Day	Daily Emissions (pounds per day)							Emissions for the Task					
			ROG	CO	NOx	PM10	PM2.5	CO2		ROG	CO	NOx	PM10	PM2.5	CO2	hours	ROG	CO	NOx	PM10	PM2.5	CO2
Off-Road Construction Vehicles	815F Sheepfoot Compactor		0.051429	0.599446	0.591347	0.022878	0.021047	111.030255	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Sheepfoot 60"		0.027551	0.345245	0.299880	0.013775	0.012673	63.946723	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Barge Mounted Dredge		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Dozer (D-6H Dozer)		0.077651	0.440637	0.759299	0.042419	0.039025	81.320666	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	LGP 325L Excavator	1	0.034218	0.359992	0.321981	0.015596	0.014349	73.942541	8	0.27	2.88	2.58	0.12	0.11	591.54	60	2.05	21.60	19.32	0.94	0.86	4436.55
	LGP 375L Excavator		0.057797	0.913251	0.565964	0.018647	0.017155	187.582279	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Telescopic Handler (Forklift)		0.022246	0.179179	0.208696	0.011297	0.010393	32.881502	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	950G Rubber Tire Loader	2	0.054465	0.438454	0.613435	0.020364	0.018735	93.266561	8	0.87	7.02	9.81	0.33	0.30	1492.26	240	13.07	105.23	147.22	4.89	4.50	22383.97
	140H Motor Grader		0.061334	0.455049	0.779056	0.024906	0.022913	87.695050	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 30 Ton		0.054200	0.253254	0.537233	0.028727	0.026429	50.715012	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	RT Crane 60 Ton		0.057492	0.447929	0.661777	0.026526	0.024404	89.699404	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Small Generator		0.010670	0.057976	0.074537	0.003611	0.003322	9.263038	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Large Generator		0.042379	0.227131	0.234202	0.012340	0.011352	31.031175	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Concrete Crane Pump Truck		0.084951	0.780438	0.922264	0.034414	0.031661	149.706511	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Tub Grinder		0.090100	0.827737	0.978159	0.036500	0.033580	158.779633	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Drill Rig	1	0.033980	0.473745	0.412080	0.011873	0.010923	117.921634	8	0.27	3.79	3.30	0.09	0.09	943.37	30	1.02	14.21	12.36	0.36	0.33	3537.65
	10 Wheel Dump 10 TON		0.062838	0.388319	0.572483	0.020858	0.019189	128.257698	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Semi End Dump 20 TON		0.106175	0.656125	0.967299	0.035242	0.032423	216.711283	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
On-Road Trucks	Foreman Op PU 4x2 TON	1	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.02	0.27	0.03	0.01	0.00	97.54	60	0.18	2.02	0.22	0.08	0.03	731.52
	Pickup 4x4 3/4 TON	2	0.002999	0.033696	0.003602	0.001288	0.000541	12.192047	8	0.05	0.54	0.06	0.02	0.01	195.07	240	0.72	8.09	0.86	0.31	0.13	2926.09
	Water Truck		0.001726	0.007867	0.051457	0.001710	0.000974	17.165125	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Service Truck		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	Flatbed 2 TON		0.004316	0.019668	0.128643	0.004276	0.002434	42.912812	8	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute Emissions		7	0.015485	0.170450	0.017920	0.006194	0.002606	58.817686	1	0.11	1.19	0.13	0.04	0.02	411.72		0.00	0.00	0.00	0.00	0.00	0.00
Sub Total										1.60	15.69	15.90	0.62	0.53	3731.51		17.04	151.15	179.99	6.57	5.85	34015.79

Table 10-A Task Emission Summary for Option A

	Tasks	Start	End	Year	Total Emissions for the Task (Construction Vehicles, Deliveries, and Fugitive Dust)						Emissions from Construction Vehicles from tabs Tasks 2018, Tasks 2019 and Tasks 2020					
					ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Task01	South Property Levee Repair	5/9/2018	6/5/2018	2018	143.85	896.98	1970.82	83.24	66.77	273637.11	65.59	487.02	707.23	31.04	27.90	97394.34
Task02	Plug Existing Culvert	6/6/2018	6/12/2018	2018	2.48	18.54	32.92	1.32	0.90	9218.44	2.10	16.81	15.85	0.92	0.67	5056.52
Task03	Terrestrial Species control	4/10/2018	4/23/2018	2018	1.51	17.27	1.88	0.55	0.23	5261.71	1.51	17.27	1.88	0.55	0.23	5261.71
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	432.53	2563.81	3755.17	476.78	207.64	651801.78	404.13	2416.37	3220.34	141.88	127.15	573746.30
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019	2018-2019	627.35	3157.66	3768.45	212.72	188.22	595823.89	626.66	3154.54	3737.60	212.00	187.81	588302.36
Task06	Aquatic Species control	10/1/2018	10/31/2018	2018	49.10	64.38	31.67	1.05	1.01	16631.45	49.10	64.38	31.67	1.05	1.01	16631.45
Task07	Clearing and Grubbing	9/11/2018	1/17/2019	2018-2019	687.57	3882.24	6961.33	3600.11	989.57	885982.30	687.57	3882.24	6961.33	345.11	312.53	885982.30
Task08	Construct Ramps	8/28/2018	9/24/2018	2018	144.58	815.29	2098.29	119.04	75.76	284411.91	39.24	262.87	430.93	19.58	17.66	53311.12
Task09	Construct Access Roads	8/28/2018	12/7/2018	2018	610.46	3445.94	8341.51	503.54	312.39	1156681.12	168.95	1125.04	1853.11	84.73	76.40	227794.55
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	402.21	2196.56	5740.93	184.85	175.40	805465.43	57.81	386.55	641.36	29.12	26.27	77933.73
Task11	Old infrastructure removal	11/20/2018	3/7/2019	2018-2019	6.60	58.15	66.48	3.11	2.80	11948.35	6.60	58.15	66.48	3.11	2.80	11948.35
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018	2018	20.62	129.90	199.21	16.05	9.19	33864.32	20.62	129.90	199.21	8.55	7.63	33864.32
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019	2019	132.74	966.65	1275.87	146.78	63.02	284764.79	132.74	966.65	1275.87	46.78	42.22	284764.79
Task14	Interior Channel Network	2/15/2019	6/5/2019	2019	2118.28	15386.75	20409.25	1535.10	839.30	4515681.55	2118.28	15386.75	20409.25	745.10	674.98	4515681.55
Task15	Dry Excavated Material	3/29/2019	8/13/2019	2019	361.13	2274.94	3921.41	177.22	160.03	457444.83	361.13	2274.94	3921.41	177.22	160.03	457444.83
Task16	Remove existing Pump (Southeast (	10/1/2019	12/6/2019	2019	5.69	34.78	56.07	2.53	2.23	9800.61	5.63	34.50	53.74	2.47	2.19	9167.07
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019	2019	23.82	185.88	247.83	52.20	19.33	36731.95	23.82	185.88	247.83	12.20	11.01	36731.95
Task18	Construct Interior Mounds	6/11/2019	7/4/2019	2019	89.78	689.10	998.07	133.29	57.69	139139.54	89.78	689.10	998.07	43.29	38.97	139139.54
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019	2019	384.07	2947.82	4269.50	570.20	246.79	595208.03	384.07	2947.82	4269.50	185.20	166.71	595208.03
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020	2019-2020	1064.22	8166.39	11808.40	1582.58	684.76	1632872.10	1064.22	8166.39	11808.40	512.58	462.20	1632872.10
Task21	Fill borrow ditch	1/20/2020	1/24/2020	2020	9.22	72.36	103.50	49.39	13.37	14000.47	9.22	72.36	103.50	4.39	4.01	14000.47
Task22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	459.91	3260.63	5127.49	492.95	240.91	850801.86	380.40	2843.11	3920.44	156.49	143.51	680473.16
Task23	Remove Access Roads	3/20/2020	4/21/2020	2020	192.38	1306.35	1791.05	136.53	76.19	392161.59	192.38	1306.35	1791.05	67.53	61.84	392161.59
Task24	Remove Ramps	4/22/2020	5/1/2020	2020	29.45	216.36	274.18	34.91	14.93	61087.36	29.45	216.36	274.18	10.91	9.93	61087.36
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	149.43	1149.32	1379.63	160.72	69.20	326039.42	149.43	1149.32	1379.63	50.72	46.32	326039.42
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	149.43	1149.32	1379.63	160.72	69.20	326039.42	149.43	1149.32	1379.63	50.72	46.32	326039.42
Task27	Planting and revegetation	8/14/2020	11/24/2020	2020	18.08	155.87	210.89	7.59	6.43	44324.17	17.04	151.15	179.99	6.57	5.85	34015.79
Total Emissions					8316.49	55209.24	86221.41	10445.07	4593.26	14416825.50	7236.91	49541.13	69879.46	2949.79	2664.16	12082054.12

	Emissions from Material Deliveries from tab Emissions-Deliveries						Fugitive Dust Emissions From tab Emissions-Fugitive Dust					
	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Task01	78.25	409.96	1263.60	37.20	35.75	176242.77				15.00	3.12	
Task02	0.38	1.72	17.07	0.40	0.23	4161.91				0.00	0.00	
Task03										0.00	0.00	
Task04	28.40	147.44	534.83	14.90	13.93	78055.48				320.00	66.56	
Task05	0.69	3.12	30.85	0.72	0.41	7521.53				0.00	0.00	
Task06										0.00	0.00	
Task07										3255.00	677.04	
Task08	105.33	552.43	1667.36	49.46	47.70	231100.79				50.00	10.40	
Task09	441.52	2320.90	6488.40	198.81	190.22	928886.57				220.00	45.76	
Task10	344.40	1810.01	5099.56	155.73	149.13	727531.70				0.00	0.00	
Task11										0.00	0.00	
Task12										7.50	1.56	
Task13										100.00	20.80	
Task14										790.00	164.32	
Task15										0.00	0.00	
Task16	0.06	0.27	2.33	0.06	0.04	633.54				0.00	0.00	
Task17										40.00	8.32	
Task18										90.00	18.72	
Task19										385.00	80.08	
Task20										1070.00	222.56	
Task21										45.00	9.36	
Task22	79.51	417.52	1207.05	36.46	35.00	170328.70				300.00	62.40	
Task23										69.00	14.35	
Task24										24.00	4.99	
Task25	0.00	0.00	0.00	0.00	0.00	0.00				110.00	22.88	
Task26	0.00	0.00	0.00	0.00	0.00	0.00				110.00	22.88	
Task27	1.04	4.72	30.90	1.03	0.58	10308.38				0.00	0.00	
Total Emissions	1079.58	5668.10	16341.95	494.78	473.00	2334771.38				7000.50	1456.10	

Table 10-B Emission Summary for the years 2018, 2019 and 2020 for Option A

	Tasks	Start	End	Year	Task Emissions in each year									
					ROG	CO	NOx	PM10	PM2.5	CO2		Prorate In the Ye	Workdays in Ye	Workdays in Year 2
Task01	South Property Levee Repair	5/9/2018	6/5/2018		143.85	896.98	1970.82	83.24	66.77	273637.11	2018			
Task02	Plug Existing Culvert	6/6/2018	6/12/2018		2.48	18.54	32.92	1.32	0.90	9218.44	2018			
Task03	Terrestrial Species control	4/10/2018	4/23/2018		1.51	17.27	1.88	0.55	0.23	5261.71	2018			
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018		432.53	2563.81	3755.17	476.78	207.64	651801.78	2018			
Task06	Aquatic Species control	10/1/2018	10/31/2018		49.10	64.38	31.67	1.05	1.01	16631.45	2018			
Task08	Construct Ramps	8/28/2018	9/24/2018		144.58	815.29	2098.29	119.04	75.76	284411.91	2018			
Task09	Construct Access Roads	8/28/2018	12/7/2018	2018	610.46	3445.94	8341.51	503.54	312.39	1156681.12	2018			
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018		402.21	2196.56	5740.93	184.85	175.40	805465.43	2018			
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018		20.62	129.90	199.21	16.05	9.19	33864.32	2018			
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019		167.29	842.04	1004.92	56.73	50.19	158886.37	2018-2019	0.27	80	220
Task07	Clearing and Grubbing	9/11/2018	1/17/2019		591.46	3339.56	5988.24	3096.87	851.25	762135.31	2018-2019	0.86	80	13
Task11	Old infrastructure removal	11/20/2018	3/7/2019		2.54	22.37	25.57	1.20	1.08	4595.52	2018-2019	0.38	30	48
Total Emissions in Year 2018				**pounds**	**2568.63**	**14352.65**	**29191.12**	**4541.21**	**1751.79**	**4162590.47**				
				tons	**1.17**	**6.51**	**13.24**	**2.06**	**0.79**	**1888.65**				
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019		460.06	2315.61	2763.53	155.99	138.03	83287.21	2018-2019	0.73	80	220
Task07	Clearing and Grubbing	9/11/2018	1/17/2019		96.11	542.68	973.09	503.24	138.33	123846.99	2018-2019	0.14	80	13
Task11	Old infrastructure removal	11/20/2018	3/7/2019		4.06	35.78	40.91	1.91	1.72	7352.83	2018-2019	0.62	30	48
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019		132.74	966.65	1275.87	146.78	63.02	284764.79	2019			
Task14	Interior Channel Network	2/15/2019	6/5/2019		2118.28	15386.75	20409.25	1535.10	839.30	4515681.55	2019			
Task15	Dry Excavated Material	3/29/2019	8/13/2019	2019	361.13	2274.94	3921.41	177.22	160.03	457444.83	2019			
Task16	Remove existing Pump (Southeast (	10/1/2019	12/6/2019		5.69	34.78	56.07	2.53	2.23	9800.61	2019			
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019		23.82	185.88	247.83	52.20	19.33	36731.95	2019			
Task18	Construct Interior Mounds	6/11/2019	7/4/2019		89.78	689.10	998.07	133.29	57.69	139139.54	2019			
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019		384.07	2947.82	4269.50	570.20	246.79	595208.03	2019			
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020		994.60	7632.14	11035.89	1479.05	639.96	1534899.77	2019-2020	0.93	100	7
Total Emissions in Year 2019				**pounds**	**4670.35**	**33012.13**	**45991.41**	**4757.52**	**2306.42**	**7788158.10**				
				tons	**2.12**	**14.98**	**20.87**	**2.16**	**1.05**	**3533.65**				
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020		69.62	534.25	772.51	103.53	44.80	106823.41	2019-2020	0.07	100	7
Task21	Fill borrow ditch	1/20/2020	1/24/2020		9.22	72.36	103.50	49.39	13.37	14000.47	2020			
Task22	Dredge Miner Slough	1/10/2020	3/19/2020		459.91	3260.63	5127.49	492.95	240.91	850801.86	2020			
Task23	Remove Access Roads	3/20/2020	4/21/2020	2020	192.38	1306.35	1791.05	136.53	76.19	392161.59	2020			
Task24	Remove Ramps	4/22/2020	5/1/2020		29.45	216.36	274.18	34.91	14.93	61087.36	2020			
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020		149.43	1149.32	1379.63	160.72	69.20	326039.42	2020			
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020		149.43	1149.32	1379.63	160.72	69.20	326039.42	2020			
Task27	Planting and revegetation	8/14/2020	11/24/2020		18.08	155.87	210.89	7.59	6.43	44324.17	2020			
Total Emissions in Year 2020				**pounds**	**1077.52**	**7844.46**	**11038.88**	**1146.34**	**535.04**	**2121277.71**				
				tons	**0.49**	**3.56**	**5.01**	**0.52**	**0.24**	**962.47**				
Total Project Emissions (2018+2019+2020)				**pounds**	**8316.49**	**55209.24**	**86221.41**	**10445.07**	**4593.26**	**14072026.27**				
				tons	**3.77**	**25.05**	**39.12**	**4.74**	**2.08**	**6384.77**				

Note: The emissions for T-05, 07 11 and 20 are prorated based on the number of workdays in the years as shown in lines 48-54 and 61-63.
So for T-05, 27 percent emissions are in 2018 and 73 percent are in 2019
for T-07, 86 percent emissions are in 2018 and 14 percent are in 2019
for T-11, 38 percent emissions are in 2018 and 62 percent are in 2019
for T-20, 93 percent emissions are in 2018 and 7 percent are in 2019

Table 11-A Task Emission Summary for Option B

	Tasks	Start	End	Year	Total Emissions for the Task (Construction Vehicles, Deliveries, and Fugitive Dust)					
					ROG	CO	NOx	PM10	PM2.5	CO2
Task01	South Property Levee Repair	5/9/2018	6/5/2018	2018	70.81	510.56	940.23	51.49	34.13	154206.97
Task02	Plug Existing Culvert	6/6/2018	6/12/2018	2018	2.48	18.54	32.92	1.32	0.90	9218.44
Task03	Terrestrial Species control	4/10/2018	4/23/2018	2018	1.51	17.27	1.88	0.55	0.23	5261.71
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	407.06	2429.63	3351.55	464.95	195.46	605737.88
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019	2018-2019	627.35	3157.66	3768.45	212.72	188.22	595823.89
Task06	Aquatic Species control	10/1/2018	10/31/2018	2018	49.10	64.38	31.67	1.05	1.01	16631.45
Task07	Clearing and Grubbing	9/11/2018	1/17/2019	2018-2019	687.57	3882.24	6961.33	3600.11	989.57	885982.30
Task08	Construct Ramps	8/28/2018	9/24/2018	2018	47.13	298.49	783.47	77.83	32.77	139271.48
Task09	Construct Access Roads	8/28/2018	12/7/2018	2018	208.34	1302.88	3613.18	345.92	145.68	656951.61
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	87.40	520.13	1963.40	60.06	43.93	400285.05
Task11	Old infrastructure removal	11/20/2018	3/7/2019	2018-2019	6.60	58.15	66.48	3.11	2.80	11948.35
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018	2018	20.62	129.90	199.21	16.05	9.19	33864.32
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019	2019	132.74	966.65	1275.87	146.78	63.02	284764.79
Task14	Interior Channel Network	2/15/2019	6/5/2019	2019	2118.28	15386.75	20409.25	1535.10	839.30	4515681.55
Task15	Dry Excavated Material	3/29/2019	8/13/2019	2019	361.13	2274.94	3921.41	177.22	160.03	457444.83
Task16	Remove existing Pump (Southeast c	10/1/2019	12/6/2019	2019	5.69	34.78	56.07	2.53	2.23	9800.61
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019	2019	23.82	185.88	247.83	52.20	19.33	36731.95
Task18	Construct Interior Mounds	6/11/2019	7/4/2019	2019	89.78	689.10	998.07	133.29	57.69	139139.54
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019	2019	384.07	2947.82	4269.50	570.20	246.79	595208.03
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020	2019-2020	1064.22	8166.39	11808.40	1582.58	684.76	1632872.10
Task21	Fill borrow ditch	1/20/2020	1/24/2020	2020	9.22	72.36	103.50	49.39	13.37	14000.47
Task22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	387.25	2874.29	4124.39	463.27	209.77	748508.50
Task23	Remove Access Roads	3/20/2020	4/21/2020	2020	192.38	1306.35	1791.05	136.53	76.19	392161.59
Task24	Remove Ramps	4/22/2020	5/1/2020	2020	29.45	216.36	274.18	34.91	14.93	61087.36
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	149.55	1149.88	1383.34	160.84	69.28	327276.43
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	149.55	1149.88	1383.34	160.84	69.28	327276.43
Task27	Planting and revegetation	8/14/2020	11/24/2020	2020	18.08	155.87	210.89	7.59	6.43	44324.17
Total Emissions					7331.20	49967.14	73970.85	10048.44	4176.27	13101461.77

	Emissions from Construction Vehicles from tabs Tasks 2018, Tasks 2019 and Tasks 2020					
	ROG	CO	NOx	PM10	PM2.5	CO2
Task01	65.59	487.02	707.23	31.04	27.90	97394.34
Task02	2.10	16.81	15.85	0.92	0.67	5056.52
Task03	1.51	17.27	1.88	0.55	0.23	5261.71
Task04	404.13	2416.37	3220.34	141.88	127.15	573746.30
Task05	626.66	3154.54	3737.60	212.00	187.81	588302.36
Task06	49.10	64.38	31.67	1.05	1.01	16631.45
Task07	687.57	3882.24	6961.33	345.11	312.53	885982.30
Task08	39.24	262.87	430.93	19.58	17.66	53311.12
Task09	168.95	1125.04	1853.11	84.73	76.40	227794.55
Task10	57.81	386.55	641.36	29.12	26.27	77933.73
Task11	6.60	58.15	66.48	3.11	2.80	11948.35
Task12	20.62	129.90	199.21	8.55	7.63	33864.32
Task13	132.74	966.65	1275.87	46.78	42.22	284764.79
Task14	2118.28	15386.75	20409.25	745.10	674.98	4515681.55
Task15	361.13	2274.94	3921.41	177.22	160.03	457444.83
Task16	5.63	34.50	53.74	2.47	2.19	9167.07
Task17	23.82	185.88	247.83	12.20	11.01	36731.95
Task18	89.78	689.10	998.07	43.29	38.97	139139.54
Task19	384.07	2947.82	4269.50	185.20	166.71	595208.03
Task20	1064.22	8166.39	11808.40	512.58	462.20	1632872.10
Task21	9.22	72.36	103.50	4.39	4.01	14000.47
Task22	380.40	2843.11	3920.44	156.49	143.51	680473.16
Task23	192.38	1306.35	1791.05	67.53	61.84	392161.59
Task24	29.45	216.36	274.18	10.91	9.93	61087.36
Task25	149.43	1149.32	1379.63	50.72	46.32	326039.42
Task26	149.43	1149.32	1379.63	50.72	46.32	326039.42
Task27	17.04	151.15	179.99	6.57	5.85	34015.79
Total Emissions	7236.91	49541.13	69879.46	2949.79	2664.16	12082054.12

	Emissions from Material Deliveries from tab Emissions-Deliveries						Fugitive Dust Emissions From tab Emissions-Fugitive Dust					
	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Task01	5.22	23.54	233.00	5.45	3.11	56812.63				15.00	3.12	
Task02	0.38	1.72	17.07	0.40	0.23	4161.91				0.00	0.00	
Task03										0.00	0.00	
Task04	2.94	13.26	131.21	3.07	1.75	31991.58				320.00	66.56	
Task05	0.69	3.12	30.85	0.72	0.41	7521.53				0.00	0.00	
Task06										0.00	0.00	
Task07										3255.00	677.04	
Task08	7.89	35.62	352.54	8.25	4.71	85960.35				50.00	10.40	
Task09	39.39	177.84	1760.07	41.19	23.51	429157.05				220.00	45.76	
Task10	29.59	133.58	1322.04	30.94	17.66	322351.32				0.00	0.00	
Task11										0.00	0.00	
Task12										7.50	1.56	
Task13										100.00	20.80	
Task14										790.00	164.32	
Task15										0.00	0.00	
Task16	0.06	0.27	2.33	0.06	0.04	633.54				0.00	0.00	
Task17										40.00	8.32	
Task18										90.00	18.72	
Task19										385.00	80.08	
Task20										1070.00	222.56	
Task21										45.00	9.36	
Task22	6.84	31.18	203.95	6.78	3.86	68035.34				300.00	62.40	
Task23										69.00	14.35	
Task24										24.00	4.99	
Task25	0.12	0.57	3.71	0.12	0.07	1237.01				110.00	22.88	
Task26	0.12	0.57	3.71	0.12	0.07	1237.01				110.00	22.88	
Task27	1.04	4.72	30.90	1.03	0.58	10308.38				0.00	0.00	
Total Emissions	94.29	426.00	4091.39	98.15	56.01	1019407.65				7000.50	1456.10	

Table 11-B Emission Summary for the years 2018, 2019 and 2020 for Option B

	Tasks	Start	End	Year	Task Emissions in each year									
					ROG	CO	NOx	PM10	PM2.5	CO2		Prorate In the Ye	Workdays in Ye	Workdays in Year 2
Task01	South Property Levee Repair	5/9/2018	6/5/2018	2018	70.81	510.56	940.23	51.49	34.13	154206.97	2018			
Task02	Plug Existing Culvert	6/6/2018	6/12/2018		2.48	18.54	32.92	1.32	0.90	9218.44	2018			
Task03	Terrestrial Species control	4/10/2018	4/23/2018		1.51	17.27	1.88	0.55	0.23	5261.71	2018			
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018		407.06	2429.63	3351.55	464.95	195.46	605737.88	2018			
Task06	Aquatic Species control	10/1/2018	10/31/2018		49.10	64.38	31.67	1.05	1.01	16631.45	2018			
Task08	Construct Ramps	8/28/2018	9/24/2018		47.13	298.49	783.47	77.83	32.77	139271.48	2018			
Task09	Construct Access Roads	8/28/2018	12/7/2018		208.34	1302.88	3613.18	345.92	145.68	656951.61	2018			
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018		87.40	520.13	1963.40	60.06	43.93	400285.05	2018			
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018		20.62	129.90	199.21	16.05	9.19	33864.32	2018			
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019		167.29	842.04	1004.92	56.73	50.19	158886.37	2018-2019	0.27	80	220
Task07	Clearing and Grubbing	9/11/2018	1/17/2019		591.46	3339.56	5988.24	3096.87	851.25	762135.31	2018-2019	0.86	80	13
Task11	Old infrastructure removal	11/20/2018	3/7/2019		2.54	22.37	25.57	1.20	1.08	4595.52	2018-2019	0.38	30	48
Total Emissions in Year 2018				**pounds**	**1655.75**	**9495.75**	**17936.23**	**4174.02**	**1365.81**	**2947046.08**				
				tons	**0.75**	**4.31**	**8.14**	**1.89**	**0.62**	**1337.14**				
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019	2019	460.06	2315.61	2763.53	155.99	138.03	83287.21	2018-2019	0.73	80	220
Task07	Clearing and Grubbing	9/11/2018	1/17/2019		96.11	542.68	973.09	503.24	138.33	123846.99	2018-2019	0.14	80	13
Task11	Old infrastructure removal	11/20/2018	3/7/2019		4.06	35.78	40.91	1.91	1.72	7352.83	2018-2019	0.62	30	48
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019		132.74	966.65	1275.87	146.78	63.02	284764.79	2019			
Task14	Interior Channel Network	2/15/2019	6/5/2019		2118.28	15386.75	20409.25	1535.10	839.30	4515681.55	2019			
Task15	Dry Excavated Material	3/29/2019	8/13/2019		361.13	2274.94	3921.41	177.22	160.03	457444.83	2019			
Task16	Remove existing Pump (Southeast c	10/1/2019	12/6/2019		5.69	34.78	56.07	2.53	2.23	9800.61	2019			
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019		23.82	185.88	247.83	52.20	19.33	36731.95	2019			
Task18	Construct Interior Mounds	6/11/2019	7/4/2019		89.78	689.10	998.07	133.29	57.69	139139.54	2019			
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019		384.07	2947.82	4269.50	570.20	246.79	595208.03	2019			
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020		994.60	7632.14	11035.89	1479.05	639.96	1534899.77	2019-2020	0.93	100	7
Total Emissions in Year 2019				**pounds**	**4670.35**	**33012.13**	**45991.41**	**4757.52**	**2306.42**	**7788158.10**				
				tons	**2.12**	**14.98**	**20.87**	**2.16**	**1.05**	**3533.65**				
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020	2020	69.62	534.25	772.51	103.53	44.80	106823.41	2019-2020	0.07	100	7
Task21	Fill borrow ditch	1/20/2020	1/24/2020		9.22	72.36	103.50	49.39	13.37	14000.47	2020			
Task22	Dredge Miner Slough	1/10/2020	3/19/2020		387.25	2874.29	4124.39	463.27	209.77	748508.50	2020			
Task23	Remove Access Roads	3/20/2020	4/21/2020		192.38	1306.35	1791.05	136.53	76.19	392161.59	2020			
Task24	Remove Ramps	4/22/2020	5/1/2020		29.45	216.36	274.18	34.91	14.93	61087.36	2020			
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020		149.55	1149.88	1383.34	160.84	69.28	327276.43	2020			
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020		149.55	1149.88	1383.34	160.84	69.28	327276.43	2020			
Task27	Planting and revegetation	8/14/2020	11/24/2020		18.08	155.87	210.89	7.59	6.43	44324.17	2020			
Total Emissions in Year 2020				**pounds**	**1005.10**	**7459.26**	**10043.21**	**1116.91**	**504.04**	**2021458.36**				
				tons	**0.46**	**3.38**	**4.56**	**0.51**	**0.23**	**917.18**				
Total Project Emissions (2018+2019+2020)				**pounds**	**7331.20**	**49967.14**	**73970.85**	**10048.44**	**4176.27**	**12756662.54**				
				tons	**3.33**	**22.67**	**33.56**	**4.56**	**1.89**	**5787.96**				

Note: The emissions for T-05, 07 11 and 20 are prorated based on the number of workdays in the years as shown in lines 48-54 and 61-63.
So for T-05, 27 percent emissions are in 2018 and 73 percent are in 2019
for T-07, 86 percent emissions are in 2018 and 14 percent are in 2019
for T-11, 38 percent emissions are in 2018 and 62 percent are in 2019
for T-20, 93 percent emissions are in 2018 and 7 percent are in 2019

Table 12-A Maximum Daily Emission Summary for Tasks and Overlapping Task Groups for Option A

	Tasks	Start	End	Year	Maximum Daily Emissions for the Task (Construction Vehicles, Deliveries, and Fugitive Dust)						Maximum Daily Emissions from Construction Vehicles from tabs Tasks 2018, Tasks 2019 and Tasks 2020						Maximum Emissions from Material Deliveries from tab Emissions-Deliveries						Fugitive Dust Emissions From tab Emissions-Fugitive Dust					
					ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Task01	South Property Levee Repair	5/9/2018	6/5/2018	2018	13.16	81.81	205.88	7.61	6.29	30065.83	5.38	41.46	56.42	2.47	2.22	8325.57	7.78	40.36	149.47	4.13	3.87	21740.27				1.00	0.21	
Task02	Plug Existing Culvert	6/6/2018	6/12/2018	2018	2.15	13.96	25.85	1.01	0.86	4589.35	2.06	13.51	21.45	0.91	0.80	3514.85	0.10	0.45	4.41	0.10	0.06	1074.50				0.00	0.00	
Task03	Terrestrial Species control	4/10/2018	4/23/2018	2018	0.09	1.03	0.11	0.03	0.01	314.13	0.09	1.03	0.11	0.03	0.01	314.13										0.00	0.00	
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	34.86	199.57	382.62	39.05	18.08	61196.03	27.13	159.46	235.60	9.97	9.04	40050.32	7.73	40.11	147.03	4.08	3.83	21145.71				25.00	5.20	
Task05	Maintenance Dewatering (Groundv	9/11/2018	11/4/2019	2018-2019	6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90				0.00	0.00	
Task06	Aquatic Species control	10/1/2018	10/31/2018	2018	48.96	62.83	31.50	1.00	0.99	16160.26	48.96	62.83	31.50	1.00	0.99	16160.26										0.00	0.00	
Task07	Clearing and Grubbing	9/11/2018	1/17/2019	2018-2019	9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23										40.00	8.32	
Task08	Construct Ramps	8/28/2018	9/24/2018	2018	11.22	64.89	173.80	15.59	7.38	22975.61	3.84	26.34	42.29	1.87	1.67	5612.16	7.38	38.55	131.52	3.71	3.63	17363.45				10.00	2.08	
Task09	Construct Access Roads	8/28/2018	12/7/2018	2018	12.03	70.40	183.31	16.00	7.74	24289.26	4.63	31.76	50.91	2.26	2.02	6710.91	7.40	38.63	132.40	3.74	3.64	17578.35				10.00	2.08	
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	10.66	60.67	167.80	5.36	5.10	22013.13	3.28	22.12	36.28	1.65	1.48	4649.67	7.38	38.55	131.52	3.71	3.63	17363.45				0.00	0.00	
Task11	Old infrastructure removal	11/20/2018	3/7/2019	2018-2019	1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00										0.00	0.00	
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018	2018	5.60	35.90	55.12	4.76	2.53	9881.98	5.60	35.90	55.12	2.26	2.01	9881.98										2.50	0.52	
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019	2019	6.68	48.81	63.84	12.36	4.20	14394.55	6.68	48.81	63.84	2.36	2.12	14394.55										10.00	2.08	
Task14	Interior Channel Network	2/15/2019	6/5/2019	2019	19.91	145.00	191.38	27.02	10.49	42714.72	19.91	145.00	191.38	7.02	6.33	42714.72										20.00	4.16	
Task15	Dry Excavated Material	3/29/2019	8/13/2019	2019	3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54										0.00	0.00	
Task16	Remove existing Pump (Southeast c	10/1/2019	12/6/2019	2019	1.50	8.86	16.13	0.71	0.60	3205.03	1.44	8.58	13.79	0.65	0.56	2571.49	0.06	0.27	2.33	0.06	0.04	633.54				0.00	0.00	
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019	2019	3.42	26.79	35.43	11.75	3.66	5325.58	3.42	26.79	35.43	1.75	1.58	5325.58										10.00	2.08	
Task18	Construct Interior Mounds	6/11/2019	7/4/2019	2019	5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13										10.00	2.08	
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019	2019	5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13										10.00	2.08	
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020	2019-2020	9.99	76.80	110.41	24.81	8.49	15416.80	9.99	76.80	110.41	4.81	4.33	15416.80										20.00	4.16	
Task21	Fill borrow ditch	1/20/2020	1/24/2020	2020	3.21	25.62	34.66	21.52	5.52	5186.13	3.21	25.62	34.66	1.52	1.36	5186.13										20.00	4.16	
Task22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	18.37	121.06	240.14	28.11	11.75	38409.84	10.99	82.51	108.62	4.40	3.96	21046.38	7.38	38.55	131.52	3.71	3.63	17363.45				20.00	4.16	
Task23	Remove Access Roads	3/20/2020	4/21/2020	2020	8.63	59.76	78.18	6.04	3.36	18079.07	8.63	59.76	78.18	3.04	2.73	18079.07										3.00	0.62	
Task24	Remove Ramps	4/22/2020	5/1/2020	2020	3.86	28.98	34.48	4.43	1.90	8311.58	3.86	28.98	34.48	1.43	1.27	8311.58										3.00	0.62	
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	10.31	72.13	97.29	18.69	6.43	21727.65	7.38	56.58	67.14	2.59	2.30	16592.44	2.93	15.55	30.15	1.10	1.01	5135.21				15.00	3.12	
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	10.31	72.13	97.29	18.69	6.43	21727.65	7.38	56.58	67.14	2.59	2.30	16592.44	2.93	15.55	30.15	1.10	1.01	5135.21				15.00	3.12	
Task27	Planting and revegetation	8/14/2020	11/24/2020	2020	1.70	16.16	18.99	0.72	0.59	4762.35	1.60	15.69	15.90	0.62	0.53	3731.51	0.10	0.47	3.09	0.10	0.06	1030.84				0.00	0.00	
overlapping task group 1	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task07				9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	8.32	0.00
	Task08				11.22	64.89	173.80	15.59	7.38	22975.61	3.84	26.34	42.29	1.87	1.67	5612.16	7.38	38.55	131.52	3.71	3.63	17363.45	0.00	0.00	0.00	10.00	2.08	0.00
	Task09				12.03	70.40	183.31	16.00	7.74	24289.26	4.63	31.76	50.91	2.26	2.02	6710.91	7.40	38.63	132.40	3.74	3.64	17578.35	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**39.15**	**230.78**	**499.72**	**78.48**	**29.63**	**68885.00**	**24.35**	**153.51**	**234.92**	**11.01**	**9.87**	**33728.29**	**14.80**	**77.27**	**264.80**	**7.47**	**7.28**	**35156.71**	**0.00**	**0.00**	**0.00**	**60.00**	**12.48**	**0.00**
overlapping task group 2	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task06				48.96	62.83	31.50	1.00	0.99	16160.26	48.96	62.83	31.50	1.00	0.99	16160.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task07				9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	8.32	0.00
	Task09				12.03	70.40	183.31	16.00	7.74	24289.26	4.63	31.76	50.91	2.26	2.02	6710.91	7.40	38.63	132.40	3.74	3.64	17578.35	0.00	0.00	0.00	10.00	2.08	0.00
	Task10				10.66	60.67	167.80	5.36	5.10	22013.13	3.28	22.12	36.28	1.65	1.48	4649.67	7.38	38.55	131.52	3.71	3.63	17363.45	0.00	0.00	0.00	0.00	0.00	0.00
	Sum				**87.55**	**289.38**	**525.22**	**69.26**	**28.34**	**84082.77**	**72.75**	**212.11**	**260.42**	**11.79**	**10.66**	**48926.06**	**14.80**	**77.27**	**264.80**	**7.47**	**7.28**	**35156.71**	**0.00**	**0.00**	**0.00**	**50.00**	**10.40**	**0.00**
overlapping task group 3	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task07				9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	8.32	0.00
	Task09				12.03	70.40	183.31	16.00	7.74	24289.26	4.63	31.76	50.91	2.26	2.02	6710.91	7.40	38.63	132.40	3.74	3.64	17578.35	0.00	0.00	0.00	10.00	2.08	0.00
	Task11				1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task12				5.60	35.90	55.12	4.76	2.53	9881.98	5.60	35.90	55.12	2.26	2.01	9881.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.52	0.00
	Sum				**34.90**	**214.07**	**394.39**	**68.29**	**25.35**	**58377.38**	**27.48**	**175.34**	**261.12**	**12.04**	**10.78**	**40584.12**	**7.42**	**38.72**	**133.28**	**3.76**	**3.65**	**17793.26**	**0.00**	**0.00**	**0.00**	**52.50**	**10.92**	**0.00**
overlapping task group 4	Task05				6.68	48.81	63.84	12.36	4.20	14394.55	6.68	48.81	63.84	2.36	2.12	14394.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task11				1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task13				6.68	48.81	63.84	12.36	4.20	14394.55	6.68	48.81	63.84	2.36	2.12	14394.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**14.73**	**109.89**	**141.05**	**25.35**	**8.96**	**31375.11**	**14.73**	**109.89**	**141.05**	**5.35**	**4.80**	**31375.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 5	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task11				1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task14				19.91	145.00	191.38	27.02	10.49	42714.72	19.91	145.00	191.38	7.02	6.33	42714.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**27.85**	**197.51**	**253.11**	**29.97**	**13.11**	**54203.62**	**27.83**	**197.42**	**252.22**	**9.95**	**8.94**	**53988.72**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 5	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task14				19.91	145.00	191.38	27.02	10.49	42714.72	19.91	145.00	191.38	7.02	6.33	42714.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum				**30.17**	**208.57**	**280.02**	**31.14**	**14.18**	**56385.15**	**30.15**	**208.48**	**279.14**	**11.12**	**10.01**	**56170.25**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 6	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task17				3.42	26.79	35.43	11.75	3.66	5325.58	3.42	26.79	35.43	1.75	1.58	5325.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task19				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**18.70**	**128.89**	**179.55**	**28.29**	**11.59**	**26804.14**	**18.68**	**128.80**	**178.67**	**8.27**	**7.42**	**26589.24**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 7	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task18				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task19				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**20.28**	**140.62**	**199.59**	**28.95**	**12.18**	**29286.70**	**20.26**	**140.53**	**198.71**	**8.93**	**8.01**	**29071.79**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 8	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task19				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task20				9.99	76.80	110.41	24.81	8.49	15416.80	9.99	76.80	110.41	4.81	4.33	15416.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**25.26**	**178.89**	**254.53**	**41.35**	**16.42**	**36895.36**	**25.24**	**178.80**	**253.65**	**11.33**	**10.17**	**36680.46**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**30.00**	**6.24**	**0.00**
overlapping task group 9	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task16				1.50	8.86	16.13	0.71	0.60	3205.03	1.44	8.58	13.79	0.65	0.56	2571.49	0.06	0.27	2.33	0.06	0.04	633.54	0.00	0.00	0.00	0.00	0.00	0.00
	Task20				9.99	76.80	110.41	24.81	8.49	15416.80	9.99	76.80	110.41	4.81	4.33	15416.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**18.06**	**125.89**	**174.90**	**27.83**	**11.13**	**27524.73**	**17.98**	**125.53**	**171.68**	**7.75**	**6.93**	**26676.29**	**0.08**	**0.36**	**3.21**	**0.08**	**0.05**	**848.44**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 10	Task21				3.21	25.62	34.66	21.52	5.52	5186.13	3.21	25.62	34.66	1.52	1.36	5186.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Task22				18.37	121.06	240.14	28.11	11.75	38409.84	10.99	82.51	108.62	4.40	3.96	21046.38	7.38	38.55	131.52	3.71	3.63	17363.45	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**21.58**	**146.67**	**274.80**	**49.63**	**17.27**	**43595.97**	**14.20**	**108.13**	**143.28**	**5.91**	**5.32**	**26232.52**	**7.38**	**38.55**	**131.52**	**3.71**	**3.63**	**17363.45**	**0.00**	**0.00**	**0.00**	**40.00**	**8.32**	**0.00**
Maximum Daily Emissions for each task and overlapping tasks					**87.55**	**289.38**	**525.22**	**78.48**	**29.63**	**84082.77**	**72.75**	**212.11**	**279.14**	**12.04**	**10.78**	**56170.25**	**14.80**	**77.27**	**264.80**	**7.47**	**7.28**	**35156.71**	**0.00**	**0.00**	**0.00**	**60.00**	**12.48**	**0.00**

Table 12-B Maximum Daily Emission Summary for Tasks and Overlapping Task Groups -Option B (material delivery by trucks only)

	Tasks	Start	End	Year	Maximum Daily Emissions for the Task (Construction Vehicles, Deliveries, and Fugitive Dust)						Maximum Daily Emissions from Construction Vehicles from tabs Tasks 2018, Tasks 2019 and Tasks 2020						Maximum Emissions from Material Deliveries from tab Emissions-Deliveries						Fugitive Dust Emissions From tab Emissions-Fugitive Dust					
					ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2	ROG	CO	NOx	PM10	PM2.5	CO2
Task01	South Property Levee Repair	5/9/2018	6/5/2018	2018	6.31	45.67	98.16	4.45	2.98	18504.70	5.38	41.46	56.42	2.47	2.22	8325.57	0.93	4.22	41.75	0.98	0.56	10179.14				1.00	0.21	
Task02	Plug Existing Culvert	6/6/2018	6/12/2018	2018	2.15	13.96	25.85	1.01	0.86	4589.35	2.06	13.51	21.45	0.91	0.80	3514.85	0.10	0.45	4.41	0.10	0.06	1074.50				0.00	0.00	
Task03	Terrestrial Species control	4/10/2018	4/23/2018	2018	0.09	1.03	0.11	0.03	0.01	314.13	0.09	1.03	0.11	0.03	0.01	314.13										0.00	0.00	
Task04	Initial Dewatering (Surface Water)	6/13/2018	8/27/2018	2018	27.72	162.09	261.68	35.58	14.59	46411.39	27.13	159.46	235.60	9.97	9.04	40050.32	0.58	2.64	26.09	0.61	0.35	6361.07				25.00	5.20	
Task05	Maintenance Dewatering (Groundw	9/11/2018	11/4/2019	2018-2019	6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90				0.00	0.00	
Task06	Aquatic Species control	10/1/2018	10/31/2018	2018	48.96	62.83	31.50	1.00	0.99	16160.26	48.96	62.83	31.50	1.00	0.99	16160.26										0.00	0.00	
Task07	Clearing and Grubbing	9/11/2018	1/17/2019	2018-2019	9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23										40.00	8.32	
Task08	Construct Ramps	8/28/2018	9/24/2018	2018	5.08	31.96	97.81	13.17	4.49	19150.91	3.84	26.34	42.29	1.87	1.67	5612.16	1.24	5.61	55.53	1.30	0.74	13538.76				10.00	2.08	
Task09	Construct Access Roads	8/28/2018	12/7/2018	2018	6.62	40.76	139.93	14.35	5.29	28415.90	4.63	31.76	50.91	2.26	2.02	6710.91	1.99	8.99	89.02	2.08	1.19	21704.99				10.00	2.08	
Task10	Interior Staging Area Construction	9/25/2018	10/24/2018	2018	5.05	30.14	115.60	3.51	2.53	23990.75	3.28	22.12	36.28	1.65	1.48	4649.67	1.78	8.01	79.32	1.86	1.06	19341.08				0.00	0.00	
Task11	Old infrastructure removal	11/20/2018	3/7/2019	2018-2019	1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00										0.00	0.00	
Task12	Remove Pump Stations (6)	11/20/2018	12/6/2018	2018	5.60	35.90	55.12	4.76	2.53	9881.98	5.60	35.90	55.12	2.26	2.01	9881.98										2.50	0.52	
Task13	Breach (Cross Levee)	1/18/2019	1/31/2019	2019	6.68	48.81	63.84	12.36	4.20	14394.55	6.68	48.81	63.84	2.36	2.12	14394.55										10.00	2.08	
Task14	Interior Channel Network	2/15/2019	6/5/2019	2019	19.91	145.00	191.38	27.02	10.49	42714.72	19.91	145.00	191.38	7.02	6.33	42714.72										20.00	4.16	
Task15	Dry Excavated Material	3/29/2019	8/13/2019	2019	3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54										0.00	0.00	
Task16	Remove existing Pump (Southeast	10/1/2019	12/6/2019	2019	1.50	8.86	16.13	0.71	0.60	3205.03	1.44	8.58	13.79	0.65	0.56	2571.49	0.06	0.27	2.33	0.06	0.04	633.54				0.00	0.00	
Task17	Fill Agricultural Ditches	6/6/2019	6/10/2019	2019	3.42	26.79	35.43	11.75	3.66	5325.58	3.42	26.79	35.43	1.75	1.58	5325.58										10.00	2.08	
Task18	Construct Interior Mounds	6/11/2019	7/4/2019	2019	5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13										10.00	2.08	
Task19	Construct Eastern Toe Berm	6/6/2019	9/20/2019	2019	5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13										10.00	2.08	
Task20	Construct Intertidal Bench	8/14/2019	1/9/2020	2019-2020	9.99	76.80	110.41	24.81	8.49	15416.80	9.99	76.80	110.41	4.81	4.33	15416.80										20.00	4.16	
Task21	Fill borrow ditch	1/20/2020	1/24/2020	2020	3.21	25.62	34.66	21.52	5.52	5186.13	3.21	25.62	34.66	1.52	1.36	5186.13										20.00	4.16	
Task22	Dredge Miner Slough	1/10/2020	3/19/2020	2020	11.40	84.40	120.98	24.81	8.35	25169.74	10.99	82.51	108.62	4.40	3.96	21046.38	0.41	1.89	12.36	0.41	0.23	4123.35				20.00	4.16	
Task23	Remove Access Roads	3/20/2020	4/21/2020	2020	8.63	59.76	78.18	6.04	3.36	18079.07	8.63	59.76	78.18	3.04	2.73	18079.07										3.00	0.62	
Task24	Remove Ramps	4/22/2020	5/1/2020	2020	3.86	28.98	34.48	4.43	1.90	8311.58	3.86	28.98	34.48	1.43	1.27	8311.58										3.00	0.62	
Task25	Breach (Northern Breach)	5/4/2020	6/23/2020	2020	7.56	57.43	72.70	17.78	5.52	18447.95	7.38	56.58	67.14	2.59	2.30	16592.44	0.19	0.85	5.56	0.18	0.11	1855.51				15.00	3.12	
Task26	Breach (Southern Breach)	6/24/2020	8/13/2020	2020	7.56	57.43	72.70	17.78	5.52	18447.95	7.38	56.58	67.14	2.59	2.30	16592.44	0.19	0.85	5.56	0.18	0.11	1855.51				15.00	3.12	
Task27	Planting and revegetation	8/14/2020	11/24/2020	2020	1.70	16.16	18.99	0.72	0.59	4762.35	1.60	15.69	15.90	0.62	0.53	3731.51	0.10	0.47	3.09	0.10	0.06	1030.84				0.00	0.00	
overlapping task group 1	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task07				9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	8.32	0.00
	Task08				5.08	31.96	97.81	13.17	4.49	19150.91	3.84	26.34	42.29	1.87	1.67	5612.16	1.24	5.61	55.53	1.30	0.74	13538.76	0.00	0.00	0.00	10.00	2.08	0.00
	Task09				6.62	40.76	139.93	14.35	5.29	28415.90	4.63	31.76	50.91	2.26	2.02	6710.91	1.99	8.99	89.02	2.08	1.19	21704.99	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**27.60**	**168.20**	**380.34**	**74.41**	**24.30**	**69186.94**	**24.35**	**153.51**	**234.92**	**11.01**	**9.87**	**33728.29**	**3.25**	**14.69**	**145.42**	**3.40**	**1.94**	**35458.64**	**0.00**	**0.00**	**0.00**	**60.00**	**12.48**	**0.00**
overlapping task group 2	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task06				48.96	62.83	31.50	1.00	0.99	16160.26	48.96	62.83	31.50	1.00	0.99	16160.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task07				9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	8.32	0.00
	Task09				6.62	40.76	139.93	14.35	5.29	28415.90	4.63	31.76	50.91	2.26	2.02	6710.91	1.99	8.99	89.02	2.08	1.19	21704.99	0.00	0.00	0.00	10.00	2.08	0.00
	Task10				5.05	30.14	115.60	3.51	2.53	23990.75	3.28	22.12	36.28	1.65	1.48	4649.67	1.78	8.01	79.32	1.86	1.06	19341.08	0.00	0.00	0.00	0.00	0.00	0.00
	Sum				**76.54**	**229.21**	**429.64**	**65.75**	**23.32**	**90187.03**	**72.75**	**212.11**	**260.42**	**11.79**	**10.66**	**48926.06**	**3.79**	**17.10**	**169.22**	**3.96**	**2.26**	**41260.97**	**0.00**	**0.00**	**0.00**	**50.00**	**10.40**	**0.00**
overlapping task group 3	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task07				9.33	55.26	94.25	44.58	12.47	12717.23	9.33	55.26	94.25	4.58	4.15	12717.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	8.32	0.00
	Task09				6.62	40.76	139.93	14.35	5.29	28415.90	4.63	31.76	50.91	2.26	2.02	6710.91	1.99	8.99	89.02	2.08	1.19	21704.99	0.00	0.00	0.00	10.00	2.08	0.00
	Task11				1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task12				5.60	35.90	55.12	4.76	2.53	9881.98	5.60	35.90	55.12	2.26	2.01	9881.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.52	0.00
	Sum				**29.49**	**184.43**	**351.01**	**66.64**	**22.90**	**62504.01**	**27.48**	**175.34**	**261.12**	**12.04**	**10.78**	**40584.12**	**2.01**	**9.08**	**89.90**	**2.10**	**1.20**	**21919.89**	**0.00**	**0.00**	**0.00**	**52.50**	**10.92**	**0.00**
overlapping task group 4	Task05				6.68	48.81	63.84	12.36	4.20	14394.55	6.68	48.81	63.84	2.36	2.12	14394.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task11				1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task13				6.68	48.81	63.84	12.36	4.20	14394.55	6.68	48.81	63.84	2.36	2.12	14394.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**14.73**	**109.89**	**141.05**	**25.35**	**8.96**	**31375.11**	**14.73**	**109.89**	**141.05**	**5.35**	**4.80**	**31375.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 5	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task11				1.38	12.27	13.37	0.64	0.57	2586.00	1.38	12.27	13.37	0.64	0.57	2586.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task14				19.91	145.00	191.38	27.02	10.49	42714.72	19.91	145.00	191.38	7.02	6.33	42714.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**27.85**	**197.51**	**253.11**	**29.97**	**13.11**	**54203.62**	**27.83**	**197.42**	**252.22**	**9.95**	**8.94**	**53988.72**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 5	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task14				19.91	145.00	191.38	27.02	10.49	42714.72	19.91	145.00	191.38	7.02	6.33	42714.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum				**30.17**	**208.57**	**280.02**	**31.14**	**14.18**	**56385.15**	**30.15**	**208.48**	**279.14**	**11.12**	**10.01**	**56170.25**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 6	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task17				3.42	26.79	35.43	11.75	3.66	5325.58	3.42	26.79	35.43	1.75	1.58	5325.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task19				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**18.70**	**128.89**	**179.55**	**28.29**	**11.59**	**26804.14**	**18.68**	**128.80**	**178.67**	**8.27**	**7.42**	**26589.24**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 7	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task18				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task19				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Sum				**20.28**	**140.62**	**199.59**	**28.95**	**12.18**	**29286.70**	**20.26**	**140.53**	**198.71**	**8.93**	**8.01**	**29071.79**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 8	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task15				3.70	23.34	40.28	1.82	1.64	4767.54	3.70	23.34	40.28	1.82	1.64	4767.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Task19				5.01	38.52	55.47	12.41	4.25	7808.13	5.01	38.52	55.47	2.41	2.17	7808.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.08	0.00
	Task20				9.99	76.80	110.41	24.81	8.49	15416.80	9.99	76.80	110.41	4.81	4.33	15416.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**25.26**	**178.89**	**254.53**	**41.35**	**16.42**	**36895.36**	**25.24**	**178.80**	**253.65**	**11.33**	**10.17**	**36680.46**	**0.02**	**0.09**	**0.88**	**0.02**	**0.01**	**214.90**	**0.00**	**0.00**	**0.00**	**30.00**	**6.24**	**0.00**
overlapping task group 9	Task05				6.56	40.24	48.36	2.31	2.05	8902.90	6.54	40.15	47.48	2.29	2.04	8688.00	0.02	0.09	0.88	0.02	0.01	214.90	0.00	0.00	0.00	0.00	0.00	0.00
	Task16				1.50	8.86	16.13	0.71	0.60	3205.03	1.44	8.58	13.79	0.65	0.56	2571.49	0.06	0.27	2.33	0.06	0.04	633.54	0.00	0.00	0.00	0.00	0.00	0.00
	Task20				9.99	76.80	110.41	24.81	8.49	15416.80	9.99	76.80	110.41	4.81	4.33	15416.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**18.06**	**125.89**	**174.90**	**27.83**	**11.13**	**27524.73**	**17.98**	**125.53**	**171.68**	**7.75**	**6.93**	**26676.29**	**0.08**	**0.36**	**3.21**	**0.08**	**0.05**	**848.44**	**0.00**	**0.00**	**0.00**	**20.00**	**4.16**	**0.00**
overlapping task group 10	Task21				3.21	25.62	34.66	21.52	5.52	5186.13	3.21	25.62	34.66	1.52	1.36	5186.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	4.16	0.00
	Task22				11.40	84.40	120.98	24.81	8.35	25169.74	10.99	82.51	108.62	4.40	3.96	21046.38	0.41	1.89	12.36	0.41	0.23	4123.35	0.00	0.00	0.00	20.00	4.16	0.00
	Sum				**14.61**	**110.02**	**155.64**	**46.32**	**13.87**	**30355.87**	**14.20**	**108.13**	**143.28**	**5.91**	**5.32**	**26232.52**	**0.41**	**1.89**	**12.36**	**0.41**	**0.23**	**4123.35**	**0.00**	**0.00**	**0.00**	**40.00**	**8.32**	**0.00**
Maximum Daily Emissions for each task and overlapping tasks					**76.54**	**229.21**	**429.64**	**74.41**	**24.30**	**90187.03**	**72.75**	**212.11**	**279.14**	**12.04**	**10.78**	**56170.25**	**3.79**	**17.10**	**169.22**	**3.96**	**2.26**	**41260.97**	**0.00**	**0.00**	**0.00**	**60.00**	**12.48**	**0.00**

x

Table 13 Project Emission Summary

Option A: Material Delivery Using Barges						
Pollutants	ROG	CO	NOx	PM10	PM2.5	CO2
2018 Emissions (tons)	1.2	6.5	13.2	2.1	0.8	1888.7
2019 Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
2020 Emissions (tons)	0.5	3.6	5.0	0.5	0.2	962.5
Maximum Annual Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
Total Project Emissions (tons)	3.8	25.0	39.1	4.7	2.1	6384.8
Option B: Material Delivery Using Trucks						
2018 Emissions (tons)	0.8	4.3	8.1	1.9	0.6	1337.1
2019 Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
2020 Emissions (tons)	0.5	3.4	4.6	0.5	0.2	917.2
Maximum Annual Emissions (tons)	2.1	15.0	20.9	2.2	1.0	3533.6
Total Project Emissions (tons)	3.3	22.7	33.6	4.6	1.9	5788.0

Table 14 Maximum Daily Emissions

	ROG	CO	NOx	PM10	PM2.5	CO2
Maximum Daily Emissions Option A (pounds per day)	87.5	289.4	525.2	78.5	29.6	84082.8
Maximum Daily Emissions Option B (pounds per day)	76.5	229.2	429.6	74.4	24.3	90187.0

Attachment 2

Roadway Construction Emission Model Projects Description

Roadway Construction Emission Model – Project 1A and 1B

These Roadway Construction Emission Model project are created to calculate the emissions rates in pounds per hour for different types of off-road construction equipment for the years 2018, 2019 and 2020, by entering the following information in the "Data Entry" sheet.

The "Construction Start Year" was set to 2018 and "Project Construction Time" was set to 48 months. In the Construction Periods table, override the construction months of each construction phase to 12 months, so the first phase "Grubbing/Land Clearing" phase is for the year of 2018, the second phase "Grading /Excavation" is for the 2019 and so on.

In the last table of the "Data Entry" sheet, override the horsepower values with the values in Table 3-A "Construction Equipment Descriptions" of Attachment 1, and change "hours per day" from the default value 8 to 1. In "Off-Road Equipment Emissions" tables for each construction phases, override of default number of vehicles to 1 for all the equipment type. These tables contain the emission rates in pounds per hour per vehicle. The table for the first phase "Grubbing/Land Clearing" contains the emission rates for the year of 2018, the table for the second phase "Grading /Excavation" contains the emission rates for the year of 2019, and the table for the third phase "Grading /Excavation" contains the emission rates for the year of 2020.

Road Construction Emissions Model

Version 7.1.5.1

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	Project 1-A Construction Equipment Set 1	
Construction Start Year	2018	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	48.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	1	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	4.00	miles
Total Project Area	5.00	acres
Maximum Area Disturbed/Day	5.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.00	yd^3/day
Soil Exported	0.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing	12.00	4.80	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	12.00	19.20	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	12.00	16.80	0.00	0.00	0.00	0.00	0.00	0.00
Paving	12.00	7.20	0.00	0.00	0.00	0.00	0.00	0.00
Totals	48.00	48.00						

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip	50.00	30
Round trips/day		0
Vehicle miles traveled/day (calculated)	0	

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.00	0.00	0.00	0.00	0.00	0.00
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip	30.00	20
One-way trips/day	2.00	2
No. of employees: Grubbing/Land Clearing	1.00	13
No. of employees: Grading/Excavation	1.00	25
No. of employees: Drainage/Utilities/Sub-Grade	1.00	23
No. of employees: Paving	1.00	19

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.120	0.154	1.399	0.047	0.020	443.880
Emission rate - Grading/Excavation (grams/mile)	0.112	0.140	1.291	0.047	0.020	441.739
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.105	0.129	1.196	0.047	0.020	441.856
Emission rate - Paving (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Grubbing/Land Clearing (grams/trip)	0.415	0.255	3.410	0.004	0.003	95.711
Emission rate - Grading/Excavation (grams/trip)	0.382	0.228	3.101	0.004	0.003	95.822
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.353	0.205	2.824	0.004	0.004	95.943
Emission rate - Paving (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Pounds per day - Grubbing/Land Clearing	0.018	0.022	0.200	0.006	0.003	59.084
Tons per const. Period - Grub/Land Clear	0.002	0.003	0.026	0.001	0.000	7.799
Pounds per day - Grading/Excavation	0.016	0.020	0.184	0.006	0.003	58.802
Tons per const. Period - Grading/Excavation	0.002	0.003	0.024	0.001	0.000	7.762
Pounds per day - Drainage/Utilities/Sub-Grade	0.015	0.018	0.170	0.006	0.003	58.818
Tons per const. Period - Drain/Util/Sub-Grade	0.002	0.002	0.022	0.001	0.000	7.764
Pounds per day - Paving	0.015	0.017	0.160	0.006	0.003	58.813
Tons per const. Period - Paving	0.002	0.002	0.021	0.001	0.000	7.763
tons per construction period	0.009	0.010	0.094	0.003	0.001	31.088

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	1.00	1	5.00	40		
Grading/Excavation - Exhaust	1.00	1	5.00	40		
Drainage/Utilities/Subgrade	1.00	1	5.00	40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.15	6.66	0.67	0.16	0.09	1624.61
Emission rate - Grading/Excavation (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.16	4.67	0.71	0.16	0.09	1558.59
Pounds per day - Grubbing/Land Clearing	0.00	0.07	0.01	0.00	0.00	17.89
Tons per const. Period - Grub/Land Clear	0.00	0.01	0.00	0.00	0.00	2.36
Pound per day - Grading/Excavation	0.00	0.06	0.01	0.00	0.00	17.58
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	2.32
Pound per day - Drainage/Utilities/Subgrade	0.00	0.05	0.01	0.00	0.00	17.17
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.01	0.00	0.00	0.00	2.27

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		5	50.0	6.6	10.4	1.4
Fugitive Dust - Grading/Excavation		5	50.0	10.6	10.4	2.2
Fugitive Dust - Drainage/Utilities/Subgrade		5	50.0	9.2	10.4	1.9

Off-Road Equipment Emissions

Grubbing/Land Clearing

Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.04	0.47	0.49	0.01	0.01	117.82
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.07	0.45	0.79	0.03	0.03	89.69
1.00	1	Crawler Tractors	0.09	0.44	0.91	0.05	0.05	81.43
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Excavators	0.04	0.36	0.41	0.02	0.02	73.95
1.00		Forklifts	0.03	0.18	0.28	0.02	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.08	0.00	0.00	9.26
1.00		Graders	0.07	0.46	0.88	0.03	0.03	87.99
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.07	0.39	0.75	0.03	0.03	128.38
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.78	1.01	0.04	0.04	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.05	0.60	0.65	0.02	0.02	111.04
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.06	0.44	0.74	0.03	0.02	93.29
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.6	4.6	7.0	0.3	0.3	975.4
	Grubbing/Land Clearing	tons per phase	0.1	0.6	0.9	0.0	0.0	128.8

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.03	0.47	0.43	0.01	0.01	117.57
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	Cranes	0.06	0.45	0.74	0.03	0.03	89.71
1.00	1	Crawler Tractors	0.08	0.44	0.84	0.05	0.04	81.34
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Excavators	0.04	0.36	0.36	0.02	0.02	73.93
1.00		Forklifts	0.03	0.18	0.24	0.01	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.08	0.00	0.00	9.26
1.00	1	Graders	0.06	0.46	0.81	0.03	0.02	87.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.07	0.39	0.65	0.02	0.02	128.33
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.78	0.97	0.04	0.03	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Rollers	0.05	0.60	0.61	0.02	0.02	111.03
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Rubber Tired Loaders	0.06	0.44	0.67	0.02	0.02	93.30
	2	Scrapers	2.21	14.51	25.55	1.00	0.92	3216.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.49	3.14	4.70	0.31	0.29	669.58
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	3.3	22.3	36.6	1.6	1.4	4860.4
	Grading	tons per phase	0.4	2.9	4.8	0.2	0.2	641.6

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.06	0.42	0.42	0.03	0.03	63.49
1.00		Bore/Drill Rigs	0.03	0.47	0.41	0.01	0.01	117.92
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.06	0.45	0.66	0.03	0.02	89.70
1.00		Crawler Tractors	0.08	0.44	0.76	0.04	0.04	81.32
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.03	0.36	0.32	0.02	0.01	73.94
1.00		Forklifts	0.02	0.18	0.21	0.01	0.01	32.88
1.00	1	Generator Sets	0.01	0.06	0.07	0.00	0.00	9.26
1.00	1	Graders	0.06	0.46	0.78	0.02	0.02	87.70
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.06	0.39	0.57	0.02	0.02	128.26
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.78	0.92	0.03	0.03	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.01	0.03	0.03	0.00	0.00	4.31
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Pumps	0.04	0.30	0.31	0.02	0.02	49.52
1.00		Rollers	0.05	0.60	0.59	0.02	0.02	111.03
	1	Rough Terrain Forklifts	0.02	0.25	0.22	0.01	0.01	46.60
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.05	0.44	0.61	0.02	0.02	93.27
	2	Scrapers	2.06	14.51	23.25	0.91	0.83	3215.57
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.44	3.13	4.23	0.27	0.25	669.38
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	3.2	23.3	34.4	1.5	1.4	5023.9
	Drainage	tons per phase	0.4	3.1	4.5	0.2	0.2	663.1

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.03	0.47	0.35	0.01	0.01	118.21
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.05	0.45	0.59	0.02	0.02	89.68
1.00		Crawler Tractors	0.07	0.44	0.68	0.04	0.04	81.39
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.03	0.36	0.29	0.01	0.01	73.95
1.00		Forklifts	0.02	0.18	0.18	0.01	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.07	0.00	0.00	9.26
1.00		Graders	0.06	0.45	0.73	0.02	0.02	87.55
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.06	0.39	0.48	0.02	0.02	128.25
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.78	0.75	0.03	0.03	149.71
	1	Pavers	0.03	0.35	0.31	0.01	0.01	60.23
	1	Paving Equipment	0.02	0.34	0.24	0.01	0.01	53.27
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Rollers	0.05	0.60	0.54	0.02	0.02	111.03
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.05	0.44	0.54	0.02	0.02	93.28
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.39	3.14	3.81	0.22	0.21	669.68
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	1.0	8.4	9.6	0.5	0.4	1758.4
	Paving	tons per phase	0.1	1.1	1.3	0.1	0.1	232.1
Total Emissions all Phases (tons per construction period) =>			1.1	7.7	11.6	0.5	0.5	1665.6

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63	1.00	8
Air Compressors		106	1.00	8
Bore/Drill Rigs	206.00	206	1.00	8
Cement and Mortar Mixers		10	1.00	8
Concrete/Industrial Saws		64	1.00	8
Cranes	270.00	226	1.00	8
Crawler Tractors	165.00	208	1.00	8
Crushing/Proc. Equipment		142	1.00	8
Excavators	168.00	163	1.00	8
Forklifts	142.00	89	1.00	8
Generator Sets	10.00	66	1.00	8
Graders	185.00	175	1.00	8
Off-Highway Tractors		123	1.00	8
Off-Highway Trucks	290.00	400	1.00	8
Other Construction Equipment		172	1.00	8
Other General Industrial Equipment		88	1.00	8
Other Material Handling Equipment	330.00	167	1.00	8
Pavers		126	1.00	8
Paving Equipment		131	1.00	8
Plate Compactors		8	1.00	8
Pressure Washers		26	1.00	8
Pumps		53	1.00	8
Rollers	253.00	81	1.00	8
Rough Terrain Forklifts		100	1.00	8
Rubber Tired Dozers		255	1.00	8
Rubber Tired Loaders	225.00	200	1.00	8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

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END OF DATA ENTRY SHEET

Road Construction Emissions Model

Version 7.1.5.1

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a
yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

Input Type		
Project Name	Project 1-B Construction Equipment Set 2	
Construction Start Year	2018	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	48.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	1	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	4.00	miles
Total Project Area	5.00	acres
Maximum Area Disturbed/Day	5.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.00	yd^3/day
Soil Exported	0.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing	12.00	4.80	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	12.00	19.20	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	12.00	16.80	0.00	0.00	0.00	0.00	0.00	0.00
Paving	12.00	7.20	0.00	0.00	0.00	0.00	0.00	0.00
Totals	48.00	48.00						

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip	50.00	30
Round trips/day		0
Vehicle miles traveled/day (calculated)		0

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.00	0.00	0.00	0.00	0.00	0.00
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip	30.00	20
One-way trips/day		2
No. of employees: Grubbing/Land Clearing	1.00	13
No. of employees: Grading/Excavation	1.00	25
No. of employees: Drainage/Utilities/Sub-Grade	1.00	23
No. of employees: Paving	1.00	19

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.120	0.154	1.399	0.047	0.020	443.880
Emission rate - Grading/Excavation (grams/mile)	0.112	0.140	1.291	0.047	0.020	441.739
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.105	0.129	1.196	0.047	0.020	441.856
Emission rate - Paving (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Grubbing/Land Clearing (grams/trip)	0.415	0.255	3.410	0.004	0.003	95.711
Emission rate - Grading/Excavation (grams/trip)	0.382	0.228	3.101	0.004	0.003	95.822
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.353	0.205	2.824	0.004	0.004	95.943
Emission rate - Paving (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Pounds per day - Grubbing/Land Clearing	0.018	0.022	0.200	0.006	0.003	59.084
Tons per const. Period - Grub/Land Clear	0.002	0.003	0.026	0.001	0.000	7.799
Pounds per day - Grading/Excavation	0.016	0.020	0.184	0.006	0.003	58.802
Tons per const. Period - Grading/Excavation	0.002	0.003	0.024	0.001	0.000	7.762
Pounds per day - Drainage/Utilities/Sub-Grade	0.015	0.018	0.170	0.006	0.003	58.818
Tons per const. Period - Drain/Util/Sub-Grade	0.002	0.002	0.022	0.001	0.000	7.764
Pounds per day - Paving	0.015	0.017	0.160	0.006	0.003	58.813
Tons per const. Period - Paving	0.002	0.002	0.021	0.001	0.000	7.763
tons per construction period	0.009	0.010	0.094	0.003	0.001	31.088

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	1.00	1	100.00	40		
Grading/Excavation - Exhaust	1.00	1	100.00	40		
Drainage/Utilities/Subgrade	1.00	1	100.00	40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.15	6.66	0.67	0.16	0.09	1624.61
Emission rate - Grading/Excavation (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.16	4.67	0.71	0.16	0.09	1558.59
Pounds per day - Grubbing/Land Clearing	0.03	1.47	0.15	0.03	0.02	357.84
Tons per const. Period - Grub/Land Clear	0.00	0.19	0.02	0.00	0.00	47.24
Pound per day - Grading/Excavation	0.03	1.29	0.15	0.03	0.02	351.65
Tons per const. Period - Grading/Excavation	0.00	0.17	0.02	0.00	0.00	46.42
Pound per day - Drainage/Utilities/Subgrade	0.03	1.03	0.16	0.03	0.02	343.30
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.14	0.02	0.00	0.00	45.32

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		5	50.0	6.6	10.4	1.4
Fugitive Dust - Grading/Excavation		5	50.0	10.6	10.4	2.2
Fugitive Dust - Drainage/Utilities/Subgrade		5	50.0	9.2	10.4	1.9

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.06	0.25	0.63	0.03	0.03	50.71
	1	Crawler Tractors	0.08	0.56	1.04	0.04	0.04	103.12
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Excavators	0.07	0.91	0.74	0.02	0.02	187.78
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Generator Sets	0.05	0.23	0.25	0.02	0.01	31.03
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.99	5.25	10.19	0.37	0.34	1735.35
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.83	1.07	0.04	0.04	158.78
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.03	0.35	0.39	0.02	0.02	63.94
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
	8	Signal Boards	0.28	1.29	1.23	0.07	0.07	157.43
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	1.7	9.7	15.5	0.6	0.6	2488.1
	Grubbing/Land Clearing	tons per phase	0.2	1.3	2.1	0.1	0.1	328.4

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	Cranes	0.06	0.25	0.57	0.03	0.03	50.72
	1	Crawler Tractors	0.08	0.56	0.98	0.04	0.03	103.06
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Excavators	0.06	0.91	0.64	0.02	0.02	187.77
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Generator Sets	0.05	0.23	0.24	0.01	0.01	31.03
	1	Graders	0.10	0.43	0.95	0.05	0.05	83.36
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.91	5.25	8.80	0.32	0.29	1734.61
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.83	1.03	0.04	0.04	158.78
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Rollers	0.03	0.35	0.33	0.02	0.01	63.95
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Rubber Tired Loaders	0.05	0.39	0.60	0.02	0.02	82.82
	2	Scrapers	0.28	1.81	3.19	0.13	0.12	402.00
	8	Signal Boards	0.25	1.26	1.18	0.07	0.06	157.43
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.06	0.39	0.59	0.04	0.04	83.70
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	2.0	12.7	19.1	0.8	0.7	3139.2
	Grading	tons per phase	0.3	1.7	2.5	0.1	0.1	414.4

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.06	0.42	0.42	0.03	0.03	63.49
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.05	0.25	0.54	0.03	0.03	50.72
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.06	0.91	0.57	0.02	0.02	187.58
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Generator Sets	0.04	0.23	0.23	0.01	0.01	31.03
	1	Graders	0.09	0.43	0.87	0.05	0.04	83.30
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.85	5.25	7.74	0.28	0.26	1733.69
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.83	0.98	0.04	0.03	158.78
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.01	0.03	0.03	0.00	0.00	4.31
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Pumps	0.04	0.30	0.31	0.02	0.02	49.52
1.00		Rollers	0.03	0.35	0.30	0.01	0.01	63.95
	1	Rough Terrain Forklifts	0.02	0.25	0.22	0.01	0.01	46.60
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
	2	Scrapers	0.26	1.81	2.91	0.11	0.10	401.95
	8	Signal Boards	0.22	1.23	1.14	0.06	0.05	157.43
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.06	0.39	0.53	0.03	0.03	83.67
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	1.9	12.7	16.8	0.7	0.6	3116.0
	Drainage	tons per phase	0.2	1.7	2.2	0.1	0.1	411.3

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.05	0.25	0.49	0.03	0.02	50.71
		Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.05	0.91	0.48	0.02	0.01	187.31
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Generator Sets	0.03	0.21	0.22	0.01	0.01	31.03
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.78	5.25	6.44	0.24	0.22	1733.56
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.83	0.79	0.03	0.03	158.78
	1	Pavers	0.03	0.35	0.31	0.01	0.01	60.23
	1	Paving Equipment	0.02	0.34	0.24	0.01	0.01	53.27
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Rollers	0.02	0.35	0.26	0.01	0.01	63.96
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
	8	Signal Boards	0.20	1.21	1.11	0.05	0.05	157.43
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.05	0.39	0.48	0.03	0.03	83.71
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	1.3	10.1	10.8	0.4	0.4	2580.0
	Paving	tons per phase	0.2	1.3	1.4	0.1	0.1	340.6
Total Emissions all Phases (tons per construction period) =>			0.9	6.0	8.2	0.3	0.3	1494.7

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63	1.00	8
Air Compressors		106	1.00	8
Bore/Drill Rigs		206	1.00	8
Cement and Mortar Mixers		10	1.00	8
Concrete/Industrial Saws		64	1.00	8
Cranes	152.00	226	1.00	8
Crawler Tractors		208	1.00	8
Crushing/Proc. Equipment		142	1.00	8
Excavators	428.00	163	1.00	8
Forklifts		89	1.00	8
Generator Sets	33.50	66	1.00	8
Graders		175	1.00	8
Off-Highway Tractors		123	1.00	8
Off-Highway Trucks	490.00	400	8.00	8
Other Construction Equipment		172	1.00	8
Other General Industrial Equipment		88	1.00	8
Other Material Handling Equipment	350.00	167	1.00	8
Pavers		126	1.00	8
Paving Equipment		131	1.00	8
Plate Compactors		8	1.00	8
Pressure Washers		26	1.00	8
Pumps		53	1.00	8
Rollers	148.00	81	1.00	8
Rough Terrain Forklifts		100	1.00	8
Rubber Tired Dozers		255	1.00	8
Rubber Tired Loaders		200	1.00	8
Scrapers		362	1.00	8
Signal Boards		20	1.00	8
Skid Steer Loaders		65	1.00	8
Surfacing Equipment		254	1.00	8
Sweepers/Scrubbers		64	1.00	8
Tractors/Loaders/Backhoes		98	1.00	8
Trenchers		81	1.00	8
Welders		45	1.00	8

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END OF DATA ENTRY SHEET

Roadway Construction Emission Model – Project 2A and 2B

These Roadway Construction Emission Model projects are created to calculate the emissions rates for worker commute trips in pounds per day per worker for the years 2018, 2019 and 2020. It also calculates the emissions rates for water trucks.

The “Construction Start Year” was set to 2018 and “Project Construction Time” was set to 48 months. In the Construction Periods table, override the construction months of each construction phase to 12 months, so the first phase “Grubbing/Land Clearing” phase is for the year of 2018, the second phase “Grading /Excavation” is for the 2019 and so on.

In Worker Commute Emissions table, enter 30 miles for one-way trip and set number of one-way trips to 2. Set the number of employees to 1. The resulting emissions for each construction phase are the emission rates in pounds per day per employee for the years 2018 through 2021 (Project 2A). The Roadway Model uses the EMFAC2011 emission factors for “Light Duty Trucks” to calculate worker commute emissions. The hourly emissions for pick-ups and foreman trucks are calculated using the same method. Assuming these vehicles would travel 100 miles per day on a typical workday, the daily emissions are obtained (Project 2B). The hourly emissions for the years 2018, 2019 and 2020 are one eighth of the daily emissions, and the assumptions and results are summarized in Table 5-B of Attachment 1.

The hourly emissions of the water trucks, service trucks and flat-bed trucks are calculated by inputting miles travelled per day in Water Truck Emissions table. The Roadway Model uses the EMFAC2011 emission factors for the “Heavy-Heavy Duty Diesel Truck” to calculate emissions of water trucks, so the emissions of the service trucks and flat-bed trucks are calculated the same way. Assume a water truck would travel 40 miles per day on an eight-hour workday. To calculate the emissions per hour, enter 5 miles per day in Water Truck Emissions table (Project 2A). The resulting emissions would be the water truck emissions in pounds per hour for the years 2018 through 2021. Assuming the service trucks and flat-bed trucks would travel 100 miles on a typical workday (namely 12.5 miles per hour), the hourly emissions can be obtained (Project 2B). The assumptions and results are summarized in Table 5-B of Attachment 1.

In addition, the emission rates (in grams per mile) for on-road soil hauling trucks are obtained from the Soil Hauling Emissions section and Water Truck Emissions section of the Roadway Construction Emission Model, both of them are based on the EMFAC2011 emission factors for “Heavy-Heavy Duty Diesel Trucks”. The results are summarized in Table 5-G of Attachment 1.

Road Construction Emissions Model

Version 7.1.5.1

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

Input Type

Project Name	Project 2-A Worker Commute and Water Truck	
Construction Start Year	2018	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	48.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	1	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	4.00	miles
Total Project Area	5.00	acres
Maximum Area Disturbed/Day	5.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.00	yd^3/day
Soil Exported	0.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing	12.00	4.80	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	12.00	19.20	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	12.00	16.80	0.00	0.00	0.00	0.00	0.00	0.00
Paving	12.00	7.20	0.00	0.00	0.00	0.00	0.00	0.00
Totals	48.00	48.00						

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip	50.00	30
Round trips/day		0
Vehicle miles traveled/day (calculated)		0

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.00	0.00	0.00	0.00	0.00	0.00
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip	30.00	20
One-way trips/day	2.00	2
No. of employees: Grubbing/Land Clearing	1.00	13
No. of employees: Grading/Excavation	1.00	25
No. of employees: Drainage/Utilities/Sub-Grade	1.00	23
No. of employees: Paving	1.00	19

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.120	0.154	1.399	0.047	0.020	443.880
Emission rate - Grading/Excavation (grams/mile)	0.112	0.140	1.291	0.047	0.020	441.739
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.105	0.129	1.196	0.047	0.020	441.856
Emission rate - Paving (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Grubbing/Land Clearing (grams/trip)	0.415	0.255	3.410	0.004	0.003	95.711
Emission rate - Grading/Excavation (grams/trip)	0.382	0.228	3.101	0.004	0.003	95.822
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.353	0.205	2.824	0.004	0.004	95.943
Emission rate - Paving (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Pounds per day - Grubbing/Land Clearing	0.018	0.022	0.200	0.006	0.003	59.084
Tons per const. Period - Grub/Land Clear	0.002	0.003	0.026	0.001	0.000	7.799
Pounds per day - Grading/Excavation	0.016	0.020	0.184	0.006	0.003	58.802
Tons per const. Period - Grading/Excavation	0.002	0.003	0.024	0.001	0.000	7.762
Pounds per day - Drainage/Utilities/Sub-Grade	0.015	0.018	0.170	0.006	0.003	58.818
Tons per const. Period - Drain/Util/Sub-Grade	0.002	0.002	0.022	0.001	0.000	7.764
Pounds per day - Paving	0.015	0.017	0.160	0.006	0.003	58.813
Tons per const. Period - Paving	0.002	0.002	0.021	0.001	0.000	7.763
tons per construction period	0.009	0.010	0.094	0.003	0.001	31.088

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	1.00	1	5.00	40		
Grading/Excavation - Exhaust	1.00	1	5.00	40		
Drainage/Utilities/Subgrade	1.00	1	5.00	40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.15	6.66	0.67	0.16	0.09	1624.61
Emission rate - Grading/Excavation (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.16	4.67	0.71	0.16	0.09	1558.59
Pounds per day - Grubbing/Land Clearing	0.00	0.07	0.01	0.00	0.00	17.89
Tons per const. Period - Grub/Land Clear	0.00	0.01	0.00	0.00	0.00	2.36
Pound per day - Grading/Excavation	0.00	0.06	0.01	0.00	0.00	17.58
Tons per const. Period - Grading/Excavation	0.00	0.01	0.00	0.00	0.00	2.32
Pound per day - Drainage/Utilities/Subgrade	0.00	0.05	0.01	0.00	0.00	17.17
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.01	0.00	0.00	0.00	2.27

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		5	50.0	6.6	10.4	1.4
Fugitive Dust - Grading/Excavation		5	50.0	10.6	10.4	2.2
Fugitive Dust - Drainage/Utilities/Subgrade		5	50.0	9.2	10.4	1.9

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.04	0.47	0.49	0.01	0.01	117.82
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.07	0.45	0.79	0.03	0.03	89.69
1.00	1	Crawler Tractors	0.09	0.44	0.91	0.05	0.05	81.43
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Excavators	0.04	0.36	0.41	0.02	0.02	73.95
1.00		Forklifts	0.03	0.18	0.28	0.02	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.08	0.00	0.00	9.26
1.00		Graders	0.07	0.46	0.88	0.03	0.03	87.99
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.07	0.39	0.75	0.03	0.03	128.38
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.78	1.01	0.04	0.04	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.05	0.60	0.65	0.02	0.02	111.04
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.06	0.44	0.74	0.03	0.02	93.29
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.6	4.6	7.0	0.3	0.3	975.4
	Grubbing/Land Clearing	tons per phase	0.1	0.6	0.9	0.0	0.0	128.8

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.03	0.47	0.43	0.01	0.01	117.57
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	Cranes	0.06	0.45	0.74	0.03	0.03	89.71
1.00	1	Crawler Tractors	0.08	0.44	0.84	0.05	0.04	81.34
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Excavators	0.04	0.36	0.36	0.02	0.02	73.93
1.00		Forklifts	0.03	0.18	0.24	0.01	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.08	0.00	0.00	9.26
1.00	1	Graders	0.06	0.46	0.81	0.03	0.02	87.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.07	0.39	0.65	0.02	0.02	128.33
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.78	0.97	0.04	0.03	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Rollers	0.05	0.60	0.61	0.02	0.02	111.03
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Rubber Tired Loaders	0.06	0.44	0.67	0.02	0.02	93.30
	2	Scrapers	2.21	14.51	25.55	1.00	0.92	3216.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.49	3.14	4.70	0.31	0.29	669.58
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	3.3	22.3	36.6	1.6	1.4	4860.4
	Grading	tons per phase	0.4	2.9	4.8	0.2	0.2	641.6

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.06	0.42	0.42	0.03	0.03	63.49
1.00		Bore/Drill Rigs	0.03	0.47	0.41	0.01	0.01	117.92
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.06	0.45	0.66	0.03	0.02	89.70
1.00		Crawler Tractors	0.08	0.44	0.76	0.04	0.04	81.32
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.03	0.36	0.32	0.02	0.01	73.94
1.00		Forklifts	0.02	0.18	0.21	0.01	0.01	32.88
1.00	1	Generator Sets	0.01	0.06	0.07	0.00	0.00	9.26
1.00	1	Graders	0.06	0.46	0.78	0.02	0.02	87.70
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.06	0.39	0.57	0.02	0.02	128.26
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.78	0.92	0.03	0.03	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.01	0.03	0.03	0.00	0.00	4.31
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Pumps	0.04	0.30	0.31	0.02	0.02	49.52
1.00		Rollers	0.05	0.60	0.59	0.02	0.02	111.03
	1	Rough Terrain Forklifts	0.02	0.25	0.22	0.01	0.01	46.60
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.05	0.44	0.61	0.02	0.02	93.27
	2	Scrapers	2.06	14.51	23.25	0.91	0.83	3215.57
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.44	3.13	4.23	0.27	0.25	669.38
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	3.2	23.3	34.4	1.5	1.4	5023.9
	Drainage	tons per phase	0.4	3.1	4.5	0.2	0.2	663.1

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.03	0.47	0.35	0.01	0.01	118.21
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.05	0.45	0.59	0.02	0.02	89.68
1.00		Crawler Tractors	0.07	0.44	0.68	0.04	0.04	81.39
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.03	0.36	0.29	0.01	0.01	73.95
1.00		Forklifts	0.02	0.18	0.18	0.01	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.07	0.00	0.00	9.26
1.00		Graders	0.06	0.45	0.73	0.02	0.02	87.55
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.06	0.39	0.48	0.02	0.02	128.25
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.78	0.75	0.03	0.03	149.71
	1	Pavers	0.03	0.35	0.31	0.01	0.01	60.23
	1	Paving Equipment	0.02	0.34	0.24	0.01	0.01	53.27
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Rollers	0.05	0.60	0.54	0.02	0.02	111.03
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.05	0.44	0.54	0.02	0.02	93.28
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.39	3.14	3.81	0.22	0.21	669.68
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	1.0	8.4	9.6	0.5	0.4	1758.4
	Paving	tons per phase	0.1	1.1	1.3	0.1	0.1	232.1
Total Emissions all Phases (tons per construction period) =>			1.1	7.7	11.6	0.5	0.5	1665.6

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63	1.00	8
Air Compressors		106	1.00	8
Bore/Drill Rigs	206.00	206	1.00	8
Cement and Mortar Mixers		10	1.00	8
Concrete/Industrial Saws		64	1.00	8
Cranes	270.00	226	1.00	8
Crawler Tractors	165.00	208	1.00	8
Crushing/Proc. Equipment		142	1.00	8
Excavators	168.00	163	1.00	8
Forklifts	142.00	89	1.00	8
Generator Sets	10.00	66	1.00	8
Graders	185.00	175	1.00	8
Off-Highway Tractors		123	1.00	8
Off-Highway Trucks	290.00	400	1.00	8
Other Construction Equipment		172	1.00	8
Other General Industrial Equipment		88	1.00	8
Other Material Handling Equipment	330.00	167	1.00	8
Pavers		126	1.00	8
Paving Equipment		131	1.00	8
Plate Compactors		8	1.00	8
Pressure Washers		26	1.00	8
Pumps		53	1.00	8
Rollers	253.00	81	1.00	8
Rough Terrain Forklifts		100	1.00	8
Rubber Tired Dozers		255	1.00	8
Rubber Tired Loaders	225.00	200	1.00	8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

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END OF DATA ENTRY SHEET

Road Construction Emissions Model
Data Entry Worksheet

Version 7.1.5.1

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells C10 through C25.

Input Type		
Project Name	Project 2-B Foreman Truck and Service Trucks	
Construction Start Year	2018	Enter a Year between 2009 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	48.00	months
Predominant Soil/Site Type: Enter 1, 2, or 3	1	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	4.00	miles
Total Project Area	5.00	acres
Maximum Area Disturbed/Day	5.00	acres
Water Trucks Used?	1	1. Yes 2. No
Soil Imported	0.00	yd^3/day
Soil Exported	0.00	yd^3/day
Average Truck Capacity	20	yd^3 (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of Construction Months	Program Calculated Months	2005	%	2006	%	2007	%
Grubbing/Land Clearing	12.00	4.80	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	12.00	19.20	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	12.00	16.80	0.00	0.00	0.00	0.00	0.00	0.00
Paving	12.00	7.20	0.00	0.00	0.00	0.00	0.00	0.00
Totals	48.00	48.00						

NOTE: soil hauling emissions are included in the Grading/Excavation Construction Period Phase, therefore the Construction Period for Grading/Excavation cannot be zero if hauling is part of the project.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions

User Input	User Override of Soil Hauling Defaults	Default Values
Miles/round trip	50.00	30
Round trips/day		0
Vehicle miles traveled/day (calculated)		0

Hauling Emissions	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day	0.00	0.00	0.00	0.00	0.00	0.00
Tons per contruction period	0.00	0.00	0.00	0.00	0.00	0.00

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions

	User Override of Worker Commute Default Values	Default Values
Miles/ one-way trip	100.00	20
One-way trips/day	1.00	2
No. of employees: Grubbing/Land Clearing	1.00	13
No. of employees: Grading/Excavation	1.00	25
No. of employees: Drainage/Utilities/Sub-Grade	1.00	23
No. of employees: Paving	1.00	19

	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.120	0.154	1.399	0.047	0.020	443.880
Emission rate - Grading/Excavation (grams/mile)	0.112	0.140	1.291	0.047	0.020	441.739
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.105	0.129	1.196	0.047	0.020	441.856
Emission rate - Paving (grams/mile)	0.101	0.120	1.122	0.047	0.020	441.814
Emission rate - Grubbing/Land Clearing (grams/trip)	0.415	0.255	3.410	0.004	0.003	95.711
Emission rate - Grading/Excavation (grams/trip)	0.382	0.228	3.101	0.004	0.003	95.822
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.353	0.205	2.824	0.004	0.004	95.943
Emission rate - Paving (grams/trip)	0.330	0.185	2.592	0.004	0.004	96.043
Pounds per day - Grubbing/Land Clearing	0.027	0.035	0.316	0.010	0.004	97.982
Tons per const. Period - Grub/Land Clear	0.004	0.005	0.042	0.001	0.001	12.934
Pounds per day - Grading/Excavation	0.025	0.031	0.291	0.010	0.004	97.510
Tons per const. Period - Grading/Excavation	0.003	0.004	0.038	0.001	0.001	12.871
Pounds per day - Drainage/Utilities/Sub-Grade	0.024	0.029	0.270	0.010	0.004	97.536
Tons per const. Period - Drain/Util/Sub-Grade	0.003	0.004	0.036	0.001	0.001	12.875
Pounds per day - Paving	0.023	0.027	0.253	0.010	0.004	97.527
Tons per const. Period - Paving	0.003	0.004	0.033	0.001	0.001	12.874
tons per construction period	0.013	0.016	0.149	0.005	0.002	51.553

Water truck default values can be overriden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Miles Traveled/Day	Default Values Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust	1.00	1	12.50	40		
Grading/Excavation - Exhaust	1.00	1	12.50	40		
Drainage/Utilities/Subgrade	1.00	1	12.50	40		
	ROG	**NOx**	**CO**	**PM10**	**PM2.5**	**CO2**
Emission rate - Grubbing/Land Clearing (grams/mile)	0.15	6.66	0.67	0.16	0.09	1624.61
Emission rate - Grading/Excavation (grams/mile)	0.15	5.88	0.69	0.16	0.09	1596.49
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.16	4.67	0.71	0.16	0.09	1558.59
Pounds per day - Grubbing/Land Clearing	0.00	0.18	0.02	0.00	0.00	44.73
Tons per const. Period - Grub/Land Clear	0.00	0.02	0.00	0.00	0.00	5.90
Pound per day - Grading/Excavation	0.00	0.16	0.02	0.00	0.00	43.96
Tons per const. Period - Grading/Excavation	0.00	0.02	0.00	0.00	0.00	5.80
Pound per day - Drainage/Utilities/Subgrade	0.00	0.13	0.02	0.00	0.00	42.91
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.02	0.00	0.00	0.00	5.66

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing		5	50.0	6.6	10.4	1.4
Fugitive Dust - Grading/Excavation		5	50.0	10.6	10.4	2.2
Fugitive Dust - Drainage/Utilities/Subgrade		5	50.0	9.2	10.4	1.9

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.04	0.47	0.49	0.01	0.01	117.82
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.07	0.45	0.79	0.03	0.03	89.69
1.00	1	Crawler Tractors	0.09	0.44	0.91	0.05	0.05	81.43
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Excavators	0.04	0.36	0.41	0.02	0.02	73.95
1.00		Forklifts	0.03	0.18	0.28	0.02	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.08	0.00	0.00	9.26
1.00		Graders	0.07	0.46	0.88	0.03	0.03	87.99
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.07	0.39	0.75	0.03	0.03	128.38
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.78	1.01	0.04	0.04	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rollers	0.05	0.60	0.65	0.02	0.02	111.04
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.06	0.44	0.74	0.03	0.02	93.29
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	0.6	4.6	7.0	0.3	0.3	975.4
	Grubbing/Land Clearing	tons per phase	0.1	0.6	0.9	0.0	0.0	128.8

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.03	0.47	0.43	0.01	0.01	117.57
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	Cranes	0.06	0.45	0.74	0.03	0.03	89.71
1.00	1	Crawler Tractors	0.08	0.44	0.84	0.05	0.04	81.34
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Excavators	0.04	0.36	0.36	0.02	0.02	73.93
1.00		Forklifts	0.03	0.18	0.24	0.01	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.08	0.00	0.00	9.26
1.00	1	Graders	0.06	0.46	0.81	0.03	0.02	87.78
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.07	0.39	0.65	0.02	0.02	128.33
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.09	0.78	0.97	0.04	0.03	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	2	Rollers	0.05	0.60	0.61	0.02	0.02	111.03
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1	Rubber Tired Loaders	0.06	0.44	0.67	0.02	0.02	93.30
	2	Scrapers	2.21	14.51	25.55	1.00	0.92	3216.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.49	3.14	4.70	0.31	0.29	669.58
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	3.3	22.3	36.6	1.6	1.4	4860.4
	Grading	tons per phase	0.4	2.9	4.8	0.2	0.2	641.6

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
	1	Air Compressors	0.06	0.42	0.42	0.03	0.03	63.49
1.00		Bore/Drill Rigs	0.03	0.47	0.41	0.01	0.01	117.92
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.06	0.45	0.66	0.03	0.02	89.70
1.00		Crawler Tractors	0.08	0.44	0.76	0.04	0.04	81.32
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.03	0.36	0.32	0.02	0.01	73.94
1.00		Forklifts	0.02	0.18	0.21	0.01	0.01	32.88
1.00	1	Generator Sets	0.01	0.06	0.07	0.00	0.00	9.26
1.00	1	Graders	0.06	0.46	0.78	0.02	0.02	87.70
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.06	0.39	0.57	0.02	0.02	128.26
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.78	0.92	0.03	0.03	149.71
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Plate Compactors	0.01	0.03	0.03	0.00	0.00	4.31
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
	1	Pumps	0.04	0.30	0.31	0.02	0.02	49.52
1.00		Rollers	0.05	0.60	0.59	0.02	0.02	111.03
	1	Rough Terrain Forklifts	0.02	0.25	0.22	0.01	0.01	46.60
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.05	0.44	0.61	0.02	0.02	93.27
	2	Scrapers	2.06	14.51	23.25	0.91	0.83	3215.57
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.44	3.13	4.23	0.27	0.25	669.38
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	3.2	23.3	34.4	1.5	1.4	5023.9
	Drainage	tons per phase	0.4	3.1	4.5	0.2	0.2	663.1

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Bore/Drill Rigs	0.03	0.47	0.35	0.01	0.01	118.21
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Cranes	0.05	0.45	0.59	0.02	0.02	89.68
1.00		Crawler Tractors	0.07	0.44	0.68	0.04	0.04	81.39
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	0.03	0.36	0.29	0.01	0.01	73.95
1.00		Forklifts	0.02	0.18	0.18	0.01	0.01	32.88
1.00		Generator Sets	0.01	0.06	0.07	0.00	0.00	9.26
1.00		Graders	0.06	0.45	0.73	0.02	0.02	87.55
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Off-Highway Trucks	0.06	0.39	0.48	0.02	0.02	128.25
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Other Material Handling Equipment	0.08	0.78	0.75	0.03	0.03	149.71
	1	Pavers	0.03	0.35	0.31	0.01	0.01	60.23
	1	Paving Equipment	0.02	0.34	0.24	0.01	0.01	53.27
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
1.00	3	Rollers	0.05	0.60	0.54	0.02	0.02	111.03
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Loaders	0.05	0.44	0.54	0.02	0.02	93.28
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2	Tractors/Loaders/Backhoes	0.39	3.14	3.81	0.22	0.21	669.68
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	1.0	8.4	9.6	0.5	0.4	1758.4
	Paving	tons per phase	0.1	1.1	1.3	0.1	0.1	232.1
Total Emissions all Phases (tons per construction period) =>			1.1	7.7	11.6	0.5	0.5	1665.6

Equipment default values for horsepower and hours/day can be overridden in cells C289 through C322 and E289 through E322.

Equipment		Default Values Horsepower		Default Values Hours/day
Aerial Lifts		63	1.00	8
Air Compressors		106	1.00	8
Bore/Drill Rigs	206.00	206	1.00	8
Cement and Mortar Mixers		10	1.00	8
Concrete/Industrial Saws		64	1.00	8
Cranes	270.00	226	1.00	8
Crawler Tractors	165.00	208	1.00	8
Crushing/Proc. Equipment		142	1.00	8
Excavators	168.00	163	1.00	8
Forklifts	142.00	89	1.00	8
Generator Sets	10.00	66	1.00	8
Graders	185.00	175	1.00	8
Off-Highway Tractors		123	1.00	8
Off-Highway Trucks	290.00	400	1.00	8
Other Construction Equipment		172	1.00	8
Other General Industrial Equipment		88	1.00	8
Other Material Handling Equipment	330.00	167	1.00	8
Pavers		126	1.00	8
Paving Equipment		131	1.00	8
Plate Compactors		8	1.00	8
Pressure Washers		26	1.00	8
Pumps		53	1.00	8
Rollers	253.00	81	1.00	8
Rough Terrain Forklifts		100	1.00	8
Rubber Tired Dozers		255	1.00	8
Rubber Tired Loaders	225.00	200	1.00	8
Scrapers		362		8
Signal Boards		20		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98		8
Trenchers		81		8
Welders		45		8

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END OF DATA ENTRY SHEET

Attachment 3

Emission Rates of Barges for Construction Material Delivery

Attachment 3 Emission Rates of Barges for Construction Material Delivery

E = EF0 x Fx (1 + D x A/UL) x HP x LF x Hr

Where:

The formular is taken from Emissions Estimation Methodology for Commercial Harbor Craft Operating in California

http://www.arb.ca.gov/msei/chc-appendix-b-emission-estimates-ver02-27-2012.pdf

E is the amount of emissions of a pollutant (ROG, CO, NOx, or PM) emitted during one period;

EF0 is the model year, horsepower and engine use (propulsion or auxiliary) specific zero hour emission factor (when engine is new), in gram/horsepower-hour;

F is the fuel correction factor which accounts for emission reduction benefits from burning cleaner fuel;

D is the horsepower and pollutant specific engine deterioration factor, which is the percentage increase of emission factors at the end of the useful life of the engine;

A is the age of the engine when the emissions are estimated, assume 10 years (model year 2008)

UL is the vessel type and engine use specific engine useful life;

HP is rated horsepower of the engine;

LF is the vessel type and engine use specific engine load factor;

	Pollutants	ROG	CO	NOx	PM10	CO2
Main Engine 3000 horsepower	Zero-hour Emission factors gram/horsepower-hour	0.1700	0.9200	4.5100	0.1100	568.3000
	Deteriorating Factor	0.4400	0.2500	0.2100	0.6700	0.0000
	Age (year)	10.0000	10.0000	10.0000	10.0000	10.0000
	Useful Life (Year)	21.0000	21.0000	21.0000	21.0000	21.0000
	Load Factor	0.8000	0.8000	0.8000	0.8000	0.8000
	Fuel Correction	1.0000	1.0000	0.9480	0.8220	1.0000
	Emissions Per Hour (pounds per hour)	1.0880	5.4473	24.8843	0.6311	3006.9446
Main Engine 50 horsepower	Zero-hour Emission factors	0.2299	3.0900	5.0100	0.2400	568.3000
	Deteriorating Factor	0.4400	0.2500	0.2100	0.6700	0.0000
	Age (year)	10.0000	10.0000	10.0000	10.0000	10.0000
	Useful Life (Year)	23.0000	23.0000	23.0000	23.0000	23.0000
	Load Factor	0.8000	0.8000	0.8000	0.8000	0.8000
	Fuel Correction	1.0000	1.0000	0.9480	0.8220	1.0000
	Emissions Per Hour (pounds per hou	0.0242	0.3021	0.4571	0.0225	50.1157
Emissions Per Hour (pounds per hour)		1.1121	5.7494	25.3414	0.6535	3057.0603

Notes: 1. Source of Zero Hour Emission Factors and Deterioration Factor: California Barge and Dredge Emissions Inventory Database

http://www.arb.ca.gov/msei/california_barge_dredge_emissions_inventory_database_10072011.mdb

2. Age and Userful life are based on Port of Long Los Angeles 2012 emission inventory, tables 4-1 and 4-2, for tug boats, Table 4.4.

3. Load factors are based on USEPA Current Methodologies in Preparing Mobile Source Port Related Emission Inventories, Final Report, April 2009

Table 3-3: EPA Load Factors for Harbor Craft (Page 3-6)

http://www.epa.gov/sectors/sectorinfo/sectorprofiles/ports/ports-emission-inv-april09.pdf

Choose a conservative number 0.8 for both main engines and auxiliary engines

Attachment 4

Emission Rates of the Helicopter for Aerial Herbicide Spray

Attachment 4 Emission Rates of the Helicopter for Aerial Herbicide Spray

Helicopter emissions were calculated using the "Guidance for the Determination of Helicopter Emissions, Swiss Confederation, Federal Department of the Environment, Transport, Energy and Communications (DETEC), March 2009." at

http://www.bazl.admin.ch/experten/regulation/03312/03419/03532/index.html?lang=er

The hourly and Landing/Take Off Cycle (LTO) emission rates are taken from the from the Helicopter Emissions Table at :

http://www.bazl.admin.ch/experten/regulation/03312/03419/03532/index.html?lang=en&download=NHzLpZeg7t,lnp6I0NTU042l2Z6ln1ad1IZn4Z2qZpnO2Yuq2Z6gpJCDeXx5fGym162epYbg2c_JjKbNoKSn6A--

						LTO Emissions					One-hour Operation Emissions				
Code	Aircraft_ICAO	Aircraft_Name	Engine_Name	Max SHP per engine	Number_of_Engines	LTO fuel (kg)	LTO NOx (g)	LTO HC (g)	LTO CO (g)	LTO PM non volatile (g)	One hour fuel (kg)	One hour NOx (g)	One hour HC (g)	One hour CO (g)	One hour PM non vol. (g)
H001	B06	BELL 206L	DDA250-C30P	650	1	23.6525	131.1123	291.1625	372.1083	4.2337	149.4015	1099.3339	664.8895	817.3494	32.2220

Assumptions:

The number of acres to be treated is 411, and each acre requires 15 gallons of herbicide solution, so we have (411 ac) * (15 gal/acre) * (1 tank/100 gal) = 62 tanks to spray .

So there will be 92 takeoff and landing cycles.

Assume in each hour, there are 8 LTOs, and 40 minutes is for opration, and 20 minutes for taking off, landing and loading herbicide.

Assume a helicopter will work for 8 hours to complete the task, a total of 64 LTOs can be done, the additional 2 LTOs are for mobilziation and demobilization.

Daily Emissions (in pounds per day) = (LTO Emissions (grams)* Number of LTO + One-Hour Operation Emissions (grams) * Operation Hours Per Day) / 453.59 (grams per pounds)

	HC (ROG)	CO	NOx	PM10	PM2.5
Emissions Per LTO (grams)	291.1625	372.1083	131.1123	4.2337	4.2337
Number of LTOs Each Hour	8	8	8	8	8
Hourly Operation Emissions	664.8895	817.3494	1099.3339	32.2220	32.2220
Operation Time in an Hour (in hours)	0.666666667	0.666666667	0.666666667	0.666666667	0.666666667
Emissions Each Hour (grams)	2772.5600	3521.7657	1781.7873	55.3507	55.3507
Emissions Each Hour (pounds)	6.1125	7.7642	3.9282	0.1220	0.1220

Estimate greenhouse gas emission for helicopters based on jet fuel consumption rate of 3.13 Kg CO2/ Kg fuel (20.89 lb CO2/gal with density of 0.8 Kg/L)

	Fuel	CO2
Emissions Per LTO (kg)	23.6525	74.0325
Number of LTOs Each Day	8	8
One-hour Operation Emissions (kg)	149.4015	467.6268
Operation Time in an Hour (in hours)	0.666666667	0.666666667
Emissions Each Hour (grams)	288.8213728	904.0109
Emissions Each Hour (pounds)	636.7454591	1993.013287

Appendix H

DWR GHG Emissions Reduction Plan Consistency Determination Form

DWR GHG Emissions Reduction Plan Consistency Determination Form

For Projects Using Contractors or Other Outside Labor

Print Form

This form is to be used by DWR project managers to document a DWR CEQA project's consistency with the DWR Greenhouse Gas Emissions Reduction Plan. This form is to be used only when DWR is the Lead Agency and when contractors or outside labor and equipment are use to implement the project.

California Department of Water Resources
1416 9th Steet
Sacramento, CA
95814
dwrclimatechange.water.ca.gov
www.water.ca.gov/climatechange

Additional Guidance on filling out this form can be found at:
dwrclimatecange.water.ca.gov/guidance_resources.cfm

The DWR Greenhouse Gas Emissions Reduction Plan can be accessed at:
http://www.water.ca.gov/climatechange/CAP.cfm

Project Name:	Prospect Island Tidal Habitat Restoration
Environmental Document type:	EIR
Manager's Name:	Dan Riordan
Manager's email:	Dan.Riordan@water.ca.gov
Division:	Division of Environmental Services
Office, Branch, or Field Division	Mitigation and Restoration Branch

Short Project Description:

Prospect Island Tidal Habitat Restoration Project proposes to restore tidal connectivity to up to 1,600 acres (ac) of currently diked land in Solano County, in partial fulfilment of the 8,000-ac tidal habitat restoration obligations of the 2008 USFWS Delta Smelt Biological Opinion (BiOp), RPA 4, and 2009 NMFS Salmonid BiOp.

The Proposed Project involves repairing a currently leaking levee, dewatering the island, and construction of access roads and ramps. Maintenance pumping will be required to maintain dry conditions for the duration of construction. Once dry, invasive species control, clearing and grubbing, channel excavation, and toe berm / intertidal bench construction will take place within the island. A spur channel connecting Prospect Island to Miner Slough will be dredged to accommodate tidal flows, and two levee breaches will be constructed to hydrologically connect interior Prospect Island with Miner Slough.

Project GHG Emissions Summary

Total Construction Emissions: 6400 $mtCO_2e$

Maximum Annual Construction Emissions: 3600 $mtCO_2e$

☒ All other emissions from the project not accounted for above will occur as ongoing operational, maintenance, or business activity emissions and therefore have already been accounted for and analyzed in the GGERP.

Extraordinary Construction Project Determination

Do total project construction emissions exceed 25,000 $mtCO_2e$ for the entire construction phase or exceed 12,500 $mtCO_2e$ in any single year of construction.

○ Yes - Addition analysis is required, consult with C4

◉ No - Additional analysis not required

Project GHG Reduction Plan Checklist

☒ All Project Level GHG Emissions Reduction Measures have been incorporated into the design or implementation plan for the project. (Project Level GHG Emissions Reduction Measures)

Or

☐ All feasible Project Level GHG Emissions Reduction Measures have been incorporated into the design or implementation plan for the project and and Measures not incorporated have been listed and determined not be apply to the proposed project (include as an attachment)

☒ Project does not conflict with any of the Specific Action GHG Emissions Reduction Measures (Specific Action GHG Emissions Reduction Measures)

Would implementation of the project result in additional energy demands on the SWP system of 15 GWh/yr or greater?

○ Yes ◉ No

If you answered Yes, attach a Renewable Power Procurement Plan update approval letter from the DWR SWP Power and Risk Office.

Is there substantial evidence that the effects of the proposed project may be cumulatively considerable notwithstanding the proposed project's compliance with the requirements of the DWR GHG Reduction Plan?

○ Yes ◉ No

If you answered Yes, the project is not eligible for streamlined analysis of GHG emissions using the DWR GHG Emissions Reduction Plan. (See CEQA Guidelines, section 15183.5, subdivision (b)(2).)

Based on the information provided above and information provided in associated environmental documentation completed pursuant to the above referenced project, the DWR CEQA Climate Change Committee has determined that the proposed project is consistent with the DWR Greenhouse Gas Reduction Plan and the greenhouse gasses emitted by the project are covered by the plan's analysis.

Project Manager Signature:	Daniel R. Mead	Date:	11/13/2015
C4 Approval Signature:	Matthew Correa	Date:	12/2/2015

Attachments:

☒ GHG Emissions Inventory

☐ List and Explanation of excluded Project Level GHG Emissions Reduction Measures

☐ Plan to update Renewable Energy Procurement Plan from DWR SWP Power and Risk Office