California Department of Fish and Game

Final Initial Study and Mitigated Negative Declaration

Parsons Slough Project

(State Clearinghouse Number 2010041084)

Prepared by:

VINNEDGE
ENVIRONMENTAL CONSULTING

August 2010
INITIAL STUDY AND MITIGATED NEGATIVE DECLARATION

pursuant to the California Environmental Quality Act, as amended

Parsons Slough Project

PREPARED FOR:
California Department of Fish and Game
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4005

PREPARED BY:
Vinnedge Environmental Consulting
1800 Grant Street
Berkeley, CA 94703
(510) 665-7885

in association with
Grassetti Environmental Consulting
Lux Environmental Consulting, LLC
Wetlands and Water Resources, Inc.
Michael Podlech
Holman & Associates

August 2010
TABLE OF CONTENTS

INTRODUCTION .................................................................................................................. 1
CHANGES SINCE PUBLICATION OF THE DRAFT INITIAL STUDY .............................. 1
A.  PROJECT DESCRIPTION ............................................................................................... 7
    Background ................................................................................................................. 7
    Project Description ................................................................................................... 11
    Project Construction Activities and Schedule ....................................................... 22
B.  ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED ................................. 29
C.  LEAD AGENCY DETERMINATION .......................................................................... 30
D.  EVALUATION OF ENVIRONMENTAL EFFECTS ............................................... 31
E.  EVALUATION OF ENVIRONMENTAL IMPACTS ................................................... 33
    I.  AESTHETICS ........................................................................................................ 33
    II. AGRICULTURE AND FOREST RESOURCES ...................................................... 43
    III.  AIR QUALITY ..................................................................................................... 44
    IV.  BIOLOGICAL RESOURCES ............................................................................. 49
    V.  CULTURAL RESOURCES .................................................................................. 71
    VI. GEOLOGY AND SOILS ..................................................................................... 74
    VII. HAZARDS AND HAZARDOUS MATERIALS ..................................................... 77
    VIII. HYDROLOGY AND WATER QUALITY ............................................................ 79
    IX.  LAND USE AND PLANNING ............................................................................. 89
    X.  MINERAL RESOURCES .................................................................................... 91
    XI. NOISE ................................................................................................................ 92
    XII. POPULATION AND HOUSING ....................................................................... 95
    XIII. PUBLIC SERVICES .......................................................................................... 96
    XIV. RECREATION ................................................................................................... 97
    XV.  TRANSPORTATION AND TRAFFIC ............................................................... 99
    XVI. UTILITIES AND SERVICE SYSTEMS ............................................................ 101
    XVII. MANDATORY FINDINGS OF SIGNIFICANCE .............................................. 103
F.  SOURCES .................................................................................................................. 106
    Personal Communication ......................................................................................... 106
    Literature Cited ........................................................................................................ 107
List of Preparers ............................................................................................................ 111
    Lead Agency ........................................................................................................... 111
    Initial Study Authors ............................................................................................. 111
LIST OF FIGURES

Figure 1  Project Vicinity Map ................................................................. 9
Figure 2  Project Location ................................................................. 13
Figure 3a  Sill Layout Plan and Section View ........................................ 15
Figure 3b  Sill Profile View ................................................................. 17
Figure 4  Kirby Park Staging Area ......................................................... 25
Figure 5  Aerial View – Proposed Sill Configuration ......................... 37
Figure 6  View of UPRR Bridge Looking East From Elkhorn Slough Towards Parsons Slough – Pre- and Post- Project Implementation ......................................................... 39
Figure 7  Views of Proposed Oyster Reef Sites .................................. 41
Figure 8  Existing Habitat Types Within the Parsons Slough Complex ......................................................... 53

LIST OF TABLES

Table MMRP-1  Mitigation Monitoring and Reporting Program for the Parsons Slough Project ............... 4
Table III-1  Estimated Daily Construction Air Pollutant Emissions ......................................................... 46
Table III-2  Estimated Motor Vehicle and Marine Vessel Air Pollutant Emissions ......................... 46
Table IV-1  Natural Community in the Parsons Slough Complex ......................................................... 51
Table IV-2  Construction-Related Best Management Practices ......................................................... 57
Table VIII-1 Tidal Datums within Monterey Bay ................................................................. 80
Table VIII-2 Tidal Prisms, Flood Volumes, and Habitat Extent With and Without the Proposed Sill 1 ........ 81
Table XI-1  Typical Noise Levels ................................................................. 93

APPENDICES

A.  Air Quality Calculations
B.  Biological Resources Report
C.  Hydrology and Water Quality Background
ACRONYMS AND ABBREVIATIONS

APE – area of potential effect
BMP – best management practice
BOD – biological oxygen demand
CARB - California Air Resources Board
CCA – California Coastal Act
CCC – California Coastal Commission
CDFG – California Department of Fish and Game
CEQA – California Environmental Quality Act
CESA – California Endangered Species Act
CFR – Code of Federal Regulations
CH4 – methane
CNDDDB – California Natural Diversity Database
CO2 – carbon dioxide
CO2E – carbon dioxide equivalents
CWA – Clean Water Act
CY – cubic yards
CZMA – Federal Coastal Zone Management A
dB – decibel
dBA – decibels (A-weighted)
DO – dissolved oxygen
DPS – distinct population segment
EFH – Essential Fish Habitat
EPA – Environmental Protection Agency
ESA – Federal Endangered Species Act
ESF – Elkhorn Slough Foundation
ESNERR – Elkhorn Slough National Estuarine Research Reserve
FMP – Fisheries Management Plan
GHG – greenhouse gases
HAPC – Habitat Areas of Particular Concern
HFC – hydrofluorocarbons
LiDAR – Light Detection and Ranging
MBTA – Migratory Bird Treaty Act
MBUAPCD - Monterey Bay Unified Air Pollution Control District
mg/L – milligrams per liter
MLLW – mean lower low water
MW – moment magnitude
MMPA – Marine Mammal Protection Act
MP – milepost
NAHC - Native American Heritage Commission
NAVD88 – North American Vertical Datum of 1988
NCBA – North Central Coast Air Basin
NEPA – National Environmental Policy Act
NF3 – nitrogen trifluoride
NHPA – National Historic Preservation Act
N2O – nitrous oxide
NMFS – National Marine Fisheries Services
NOAA – National Oceanic and Atmospheric Administration
NOx – nitrogen oxide
NPDES – National Pollutant Discharge Elimination System
NWIC – Northwest Information Center
OSHA – Occupational Health and Safety Administration
PFC – perfluorocarbons
PM10 - particulate matter less than 10 microns in diameter
RHA – Rivers and Harbors Act of 1899
ROG – reactive organic gases
RWQCB – Regional Water Quality Control Board
SF₆ – sulfur hexafluoride
SEL – sound exposure level
SHPO – State Historic Preservation Office
SLC – State Lands Commission
SWPPP – Stormwater Pollution Prevention Plan
SWRCB – State Water Resources Control Board

TWP – Tidal Wetland Program
UPRR – Union Pacific Railroad
USACE – U.S. Army Corps of Engineers
USGS – U.S. Geological Survey
USFWS – U.S. Fish and Wildlife Service
VOC – volatile organic compound
INTRODUCTION

This Initial Study and Mitigated Negative Declaration has been prepared pursuant to the California Environmental Quality Act of 1970 (CEQA), as amended, (commencing with Section 21000 of California’s Public Resources Code), and State CEQA Guidelines. The Lead Agency for the project, as defined by CEQA, is the California Department of Fish and Game (CDFG), which has primary jurisdiction over the project area. The project is proposed for implementation by the Elkhorn Slough National Estuarine Research Reserve (ESNERR).

The California Department of Fish and Game has determined that the proposed project is subject to environmental assessment under CEQA. Early identification of potential environmental impacts provides the basis for necessary revisions to the project design. The analysis in this document concentrates on aspects of the project that are likely to have a significant effect on the environment, and identifies feasible measures to mitigate (i.e., reduce or avoid) these impacts. The CEQA Guidelines define “significant effect on the environment” as a “substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project....” (CEQA Guidelines, Section 15382).

This document consists of the following major sections:

- Project Description – provides a brief description of existing site conditions and facilities, the proposed modifications and improvements, and the discretionary approvals required for the project to proceed.
- Environmental Checklist and Discussion – provides specific environmental topic chapters within which the following are addressed:
  1. Environmental setting or conditions, that may affect or be affected by the proposed project.
  2. Potential environmental effects and level of significance likely to result from the project as proposed.
  3. Mitigation measures that can be implemented to eliminate or substantially reduce the identified potentially significant environmental effects.
  4. References used in the analyses.
- Appendices – including relevant air quality, biological resources and hydrology/water quality background reports.

CHANGES SINCE PUBLICATION OF THE DRAFT INITIAL STUDY

The Initial Study and Draft Mitigated Negative Declaration was circulated for public review and comment for 30 days between April 23 and May 24, 2010 (State Clearinghouse Number 2010041084). One comment letter from the Central Coast Region of the California Coastal Commission (CCC) was received after the close of the public comment period. The following list summarizes the changes reflected in this document based on the CCC’s comments and modifications to the engineering design after publication of the Draft Initial Study. None of the changes reflected in this Final Initial Study / Mitigated Negative Declaration would result in new significant impacts or new mitigation measures. Mitigation, Monitoring, and Reporting Requirements are summarized in Table MMRP-1.
The project description has been updated to clarify that a 20-foot disturbance buffer is included around the footprint of the sill structure to account for temporary disturbance of sediment and vegetation during installation of the sheet pile, rockfill buttress, and/or riprap components of the sill structure.

The project description has been updated to clarify the dimensions and use of the various erosion control components associated with the proposed sill structure.

The project description has been updated to reflect that the proposed sill has been designed to accommodate 1.6 feet of sea level rise over the next 50 years. This design criterion would allow the sill structure to continue to function as water levels rise over time. From an engineering perspective, this means that the top elevation of the sill structure (9.6 feet) is equal to the maximum tide elevation observed in Monterey Bay since 1973 (8.03 feet) plus a design sea level rise of 1.6 feet to accommodate sea level rise over the 50-year design life of the sill (DU et al. 2010a).

The project description has been updated to provide more detail regarding the goals of the proposed oyster restoration project, and information on the location of borrow sites for sediment used to construct the reefs.

The project description has been updated to clarify the use of buoys and signs for boater safety in and around the proposed sill area.

The dimensions of the temporary floating dock facilities at the Kirby Park staging area have been updated to be consistent with the proposed engineering design.

The characterization of the proposed construction window has been clarified to reflect that construction would occur primarily during slack tide, but that it may occur 24-hours a day, depending on site conditions and the nature of the construction activity.

More detail has been added to the project description regarding the nature of the proposed reroute of the existing drainage along the UPRR embankment that is necessary to allow construction of the sill.

A more comprehensive discussion of the visual impacts of the proposed oyster restoration project has been added to Section I, Aesthetics.

The discussion of impacts to salt marsh habitat in Section IV, Biological Resources, has been updated to reflect that about 0.10 acre of salt marsh habitat would be temporarily disturbed during construction of the sill, and that about 0.05 acre of salt marsh habitat would be permanently impacted by installation of the infrastructure associated with the sill.

The State Water Resources Control Board (SWRCB) and the Central Coast Regional Water Quality Control Board (RWQCB) have determined that a National Pollutant Discharge Elimination System (NPDES) Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) will not be required for the proposed project. Mitigation Measure IV-1 lists best management practices (BMPs) that would be implemented to minimize adverse construction-related water quality impacts.

The impact discussion and proposed mitigation measures specific to the Southern Distinct Population Segment (DPS) of North American green sturgeon (Acipenser mediostris) have been updated based on
informal discussion with the National Marine Fisheries Service (NMFS) during the Federal Endangered Species Act (ESA) Section 7 consultation process, at which time it was determined by NMFS that green sturgeon are not expected to enter the Project area and are therefore unlikely to be affected. Mitigation Measure IV-3, which was specific to minimizing impacts on green sturgeon, has been removed because other existing mitigation measures are considered adequate to reduce potential impacts to less than significant levels. Mitigation measures specific to sound levels have been moved to the discussion of noise impacts to marine mammals.
Table MMRP-1 Mitigation Monitoring and Reporting Program for the Parsons Slough Project

<table>
<thead>
<tr>
<th>IV. BIOLOGICAL RESOURCES</th>
<th>Mitigation</th>
<th>Implementing Responsibility</th>
<th>Monitoring Responsibility</th>
<th>Mitigation Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mitigation Measure IV-1.</strong></td>
<td>The project applicant would implement the best management practices (BMPs) outlined in Table IV -2 in the Initial Study to minimizing stormwater runoff, erosion, and potential water quality impacts associated with construction activities. In addition, all contractors working in a capacity that could increase the potential adverse water quality impacts (e.g., disturbance of soil at Kirby Park, maintenance of project equipment) shall receive training regarding the environmental sensitivity of the site and need to minimize impacts. Contractors also shall be trained in implementation of stormwater BMPs for protection of water quality.</td>
<td>Construction Contractor</td>
<td>ESNERR / CDFG</td>
<td>Before, during, and after construction.</td>
</tr>
<tr>
<td><strong>Mitigation Measure IV-2.</strong></td>
<td>Marine mammal monitoring during construction of the sill shall occur from the established observation point adjacent to the UPRR bridge, as well as intermittently from a small motorized boat. Daily construction monitoring shall begin 30 minutes prior to construction activities and continue until construction personnel have left the site. The biological monitor shall maintain a log that documents the number of marine mammals present before, during, and at the end of daily activities. The monitor shall record basic weather conditions (ambient temperature, tidal activity, precipitation, wind, etc.), as well as marine mammal behavior. The biological monitor shall have authority to stop construction before a marine mammal becomes severely harassed (Level A harassment under the MMPA, defined as potential to injure a marine mammal or marine mammal stock in the wild). A report shall be completed and submitted to USFWS within 30 days of the completion of the sill construction and shall include a summary of the daily log maintained by the monitor during construction. Additional measures to minimize impacts to marine mammals shall include limiting construction to the non-pupping season (September 1 – February 28); conducting an education program for all construction personnel before the onset of construction activities; to the extent possible, conducting the most noise disturbing construction activities during high tide; gradually beginning construction activities to reduce the risk of startling marine mammals with sudden intensive sound; establishing marine mammal safety zones based on guidance provided by the National Marine Fisheries Service (NMFS); employing cushioning blocks between impact hammers and piles to reduce sound pressure levels; and conducting fueling and equipment maintenance in designated areas to prevent inadvertent fluid spills from impacting water quality.</td>
<td>Qualified Biologist</td>
<td>ESNERR / CDFG</td>
<td>Before and During Construction</td>
</tr>
</tbody>
</table>
### Mitigation Measure IV-3.
Post construction monitoring of marine mammals shall consist of a survey during peak occupational time and tidal cycle for marine mammals for four weeks following construction of the sill. If marine mammals demonstrate the ability to move freely across the structure, without evidence of harm or injury, and if marine mammals appear to have resumed normal behavior, then post construction monitoring would cease. USFWS would be consulted before the cessation of post construction monitoring. In the event that post-construction monitoring indicates that adult or juvenile marine mammals are unable to cross the sill, ESNERR would follow a phased approach to increase marine mammal passage over the sill, dependent upon monitoring results.

<table>
<thead>
<tr>
<th>V. CULTURAL RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation Measure V-1: An archaeological monitor shall be retained to observe any mechanical excavation at the proposed sill site or oyster restoration areas, if mechanical excavation is needed. The monitor would be responsible for indentifying and retrieving any prehistoric archaeological materials uncovered for analysis, as appropriate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VIII. HYDROLOGY AND WATER QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation Measure VIII-1. ESNERR shall monitor pre- and post-implementation water quality parameters including temperature, salinity, pH, and DO. The monitoring will incorporate a phased approach that tracks the development of thermal stratification in the deep area near the sill and DO at a long term monitoring station in Parsons Slough, the South Marsh Water Quality Station.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation</th>
<th>Implementing Responsibility</th>
<th>Monitoring Responsibility</th>
<th>Mitigation Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV-3</td>
<td>Qualified Biologist</td>
<td>ESNERR / CDFG</td>
<td>After Construction</td>
</tr>
<tr>
<td>V-1</td>
<td>Qualified Archaeologist</td>
<td>ESNERR / CDFG</td>
<td>During Construction</td>
</tr>
<tr>
<td>VIII-1</td>
<td>ESNERR Hydrologist</td>
<td>ESNERR / CDFG</td>
<td>Before and After Construction</td>
</tr>
<tr>
<td>Mitigation</td>
<td>Implementing Responsibility</td>
<td>Monitoring Responsibility</td>
<td>Mitigation Timing</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------</td>
<td>---------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>XI. NOISE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mitigation Measure XI-1:</strong> The construction contractor shall prepare a Noise Control Plan, subject to County review, to ensure that construction activities would not exceed 85 dBA within 50 feet of a sensitive receptor. The Noise Control Plan shall include identification of any sensitive receptors; work hour limitations for certain types of noisy activities; requirements for noise control and noise shielding features on construction equipment; specifications for activities at project staging and construction areas; conditions on delivery timing to control delivery truck noise; and identification of contacts and procedures for addressing noise complaints. Use of proper mufflers on equipment engines and enclosing engines or mounting noise shields around noisy equipment shall be included in the project contract specifications, and minimize the likelihood of exceeding the threshold.</td>
<td>Construction Contractor</td>
<td>ESNERR / CDFG</td>
<td>Before and During Construction</td>
</tr>
<tr>
<td><strong>XIV. RECREATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mitigation Measure XIV-1:</strong> A temporary 10-foot wide by 40-foot long floating dock and a 10-foot wide gravel boat ramp will be constructed for public use at the north end of the Kirby Park parking lot during construction (Figure 4). The boat ramp and dock would be installed at Kirby Park before access to the existing boat ramp is limited by construction, and would be removed when construction is complete and the existing boat ramp has been returned to working order.</td>
<td>Construction Contractor</td>
<td>ESNERR / CDFG</td>
<td>Before and After Construction</td>
</tr>
<tr>
<td><strong>Mitigation Measure XIV-2:</strong> Signs shall be posted at Kirby Park prior to construction to notify the public of construction staging at Kirby Park and to make them aware of the temporary dock and boat ramp that would be provided at the north end of the parking lot. The sign shall also include a map identifying the alternate, public boat ramp located at the North Moss Landing Harbor. Kayak rental services and other tour boat operators in the area shall be notified of this temporary change in access to Kirby Park at least three months before construction would commence. Interpretive signage explaining the purpose and environmental considerations associated with the proposed project shall be placed near the sill site (either at the entrance to Parsons Slough or at the sill itself) and at the Kirby Park parking lot to assist the public in understanding the function of the sill. Fact sheets and interpretive literature about the sill also shall be provided to all boat rental and excursion operators free of charge.</td>
<td>Construction Contractor, ESNERR</td>
<td>ESNERR / CDFG</td>
<td>Before Construction</td>
</tr>
</tbody>
</table>
A. PROJECT DESCRIPTION

1. **Project title:** Parsons Slough Project

2. **Lead agency name & address:** California Department of Fish and Game  
   1234 East Shaw Avenue  
   Fresno, California 93710

3. **Contact person & phone number:** Linda Connolly, California Department of Fish and Game  
   (559) 243-4014 extension 242

4. **Project location:** Parsons Slough Complex, about 3 miles east of Moss Landing in Elkhorn Slough, Monterey County, California

5. **Project sponsor's name & address:** Elkhorn Slough National Estuarine Research Reserve  
   1700 Elkhorn Road  
   Watsonville, CA 95076

6. **Applicable Land Use plan designation:** North County Land Use Plan (Coastal)

7. **Zoning:** Resource Conservation (Coastal Zone)

8. **Description of the Project:**

**Background**

The Parsons Slough Complex is located on the southeast side of Elkhorn Slough, an estuary in Monterey County, California (Figure 1), and consists of the 254-acre Parsons Slough and the 161-acre South Marsh Area. The Parsons Slough Complex was historically dominated by tidal salt marsh and tidal creeks. Changes in hydrology and land use, along with land subsidence, have significantly increased tidal exchange in Parsons Slough, resulting in scour of the slough and reduction in salt marsh habitat. Changes to Parsons Slough hydrology have also affected tidal exchange in the larger Elkhorn Slough system. Within the past 60 years, the proportion of salt marsh habitat to mudflat habitat within Elkhorn Slough has reversed as a result of tidal erosion and inundation of interior marsh areas. Currently, there are approximately 800 acres of salt marsh and tidal creeks within Elkhorn Slough, 1,600 acres of mudflat, and 300 acres of tidal channels. Modeling efforts predict that an additional 550 acres of salt marsh will be lost over the next 50 years if tidal erosion in Elkhorn Slough is not addressed. Without intervention, excessive erosion will continue to widen tidal channels and convert salt marsh to mudflat. This will result in a significant loss of habitat function and a decrease in estuarine biodiversity.

The Parsons Slough Project, which includes construction of a partially submerged tidal barrier (a sill) at the mouth of Parsons Slough to reduce tidal scouring, is the first planned component of the Elkhorn Slough Tidal Wetland Project (TWP). The TWP is a collaborative effort among coastal resource managers, representatives from key regulatory and jurisdictional entities, leaders of conservation organizations, scientific experts, and community members to develop and implement strategies to conserve and restore estuarine habits in the Elkhorn Slough watershed. Several goals and objectives for the long term restoration of Parsons Slough were identified during the TWP planning process, as summarized in the Parsons Slough Wetland Restoration Plan (Elkhorn Slough National Estuarine Research Reserve et al. 2010). The following objectives have been identified by the project proponent, Elkhorn Slough National Estuarine Research Reserve (ESNERR), for the proposed project.
- **Objective 1.** Reduce the tidal prism in Elkhorn Slough, particularly during spring tides, to reduce soft sediment subtidal habitat degradation that results from tidal erosion, while maintaining sufficient tidal exchange and flushing to provide acceptable water quality. The tidal prism is defined as the volume of water passing into and out of an embayment or estuary during a tidal cycle.

- **Objective 2.** Produce hydrologic and geomorphic conditions that support vegetated intertidal marsh and its associated tidal creeks, panes, and upland transitional habitat areas, both in Elkhorn Slough and Parsons Slough.

- **Objective 3.** Develop restoration designs that allow for adaptive management over time in the context of possible future conditions of the larger Elkhorn Slough system, while containing costs associated with operations and maintenance.

- **Objective 4.** Accommodate nursery and foraging habitat for estuarine fish species by providing acceptable water quality and continued access to Parsons Slough.

- **Objective 5.** Increase native populations of Olympia oyster (*Ostrea lurida*) by improving habitat conditions in Elkhorn Slough.

The proposed project is supported by the National Oceanic and Atmospheric Administration (NOAA) Restoration Center through the American Reinvestment and Recovery Act fund. NOAA will be conducting a separate review under the National Environmental Policy Act (NEPA) for the proposed project. Construction and operation of the proposed sill and installation of artificial Olympia oyster reefs in the Parsons Slough Complex are the subjects for evaluation in this California Environmental Quality Act (CEQA) document.

**Project Description**

The proposed project would include construction of a partially submerged tidal barrier (a sill) at the mouth of Parsons Slough (Figure 2). The sill would consist of a fixed structure built with steel piles, similar to an underwater wall. The proposed project would also include establishment of artificial reefs to support populations of Olympia oysters in the northeastern portions of the Parsons Slough Complex (Figure 2).

The sill structure would prevent head cutting (i.e., erosion in a channel caused by an abrupt change in slope) in Elkhorn Slough from migrating upstream into Parsons Slough, would retain sediment that accretes within Parsons Slough, and would reduce the tidal prism of Parsons Slough. This reduction in tidal prism would reduce current velocities between Parsons Slough and the mouth of Elkhorn Slough, thereby reducing tidal scour.

The proposed sill would be located about 50 feet west of the Union Pacific Railroad (UPRR) bridge, milepost (MP) 103.27 Coast Subdivision. The UPRR bridge is a 165 foot long concrete slab girder bridge that spans the Parsons Slough Channel. The rail line embankment has a crest elevation of about 8 feet (all elevations are in North American Vertical Datum of 1988 [NAVD88]) in the vicinity of the bridge, based on Light Detection and Ranging (LiDAR) data. A fiber optic cable line is buried along the east side of the rail line within the UPRR corridor right of way (Moffatt & Nichol 2008). The proposed sill would span the mouth of Parsons Slough and tie into the UPRR embankment on either side of the slough (Figure 3a and 3b).
The Parsons Slough Channel bottom elevations range between -10 to -14 feet in the area downstream of the UPRR bridge. Tides at the UPRR bridge and within the Parsons Slough Complex are approximately the same as at the nearby coast, with a mean tide range of 5.6 feet (Moffatt & Nichol 2008). The spring tide range is 8.2 feet and the neap tide range is 3.0 feet (Broenkow and Breaker 2005 in Elkhorn Slough Tidal Wetland Project Team 2007). The velocity of tidal flows at the UPRR bridge are high enough to erode the soft clay silts in which the channel is formed.

Tidal velocities measured in 2002 were 5.6 feet per second during ebb tides and 4.9 feet per second during flood tides (Moffatt & Nichol 2008).

For the purpose of this Initial Study, the “project area” is defined as all locations that would be directly or indirectly impacted by project activities, including all of Parsons Slough, all tidally influenced areas within Elkhorn Slough, and the three discrete sites that would be directly impacted by project construction activities: the proposed sill location, the proposed staging area at Kirby Park, and the Olympia oyster restoration areas in Parsons Slough (Figure 2).

**Tidal Barrier (Sill)**

The following describes in detail the components of the proposed sill. It is important to note that the dimensions and elevations described below may change slightly during engineering design. It is also important to note that the proposed sill has been designed to accommodate about 1.6 feet (0.5 meter) of sea level rise over the design life of 50 years. This design criterion would allow the sill structure to continue to function as water levels rise over time. From an engineering perspective, this means that the top elevation of the sill structure (9.6 feet) is equal to the maximum tide elevation observed in Monterey Bay since 1973 (8.03 feet) plus a design sea level rise of 1.6 feet to accommodate sea level rise over the 50-year design life of the sill (DU et al. 2010a). It is anticipated that the effectiveness of the sill to achieve the stated project objectives would decrease with sea level rise over time. Similarly, some of the sill’s potential impacts would be lessened over time.

**Structure Components**

The sill design is shown schematically in Figures 3a and 3b. The structure would be constructed of steel sheet piles and would extend 270 feet across the mouth of the Parsons Slough Channel. A 100-foot wide section in the center of the structure would allow water to flow between Parsons Slough and Elkhorn Slough. This portion of the structure would be submerged more than 99 percent of the time. The center of this part of the structure would include a notch approximately 25 feet wide, with the top elevation of the sheet pile in this notch at an elevation of -5 feet NAVD88. The notch would provide for the passage of water at all tide levels and would facilitate the movement of fish and wildlife into and out of Parsons Slough. The top elevation of the sheet pile in the remaining 75 feet of the central section of the base structure would be -2 feet NAVD88. The remaining portions of the sheet piles to the left and right of the center portion of the structure would have a top elevation of 9.6 feet.

The sheet pile wall would be supported on two rows of seven end-bearing piles. The end-bearing piles would be driven through the soft soils into the underlying dense sandy deposits to an elevation of approximately -90 feet. A rockfill buttress would be placed on both sides of the sheet pile wall, extending from the bottom of the channel to the crest of the sheet piles in the open, center section of the sill at a slope of 2:1 (2 feet wide for every 1 foot high). The rockfill buttress, which would be entirely underwater, would serve several purposes: (1) guide fish and marine animals over the sill; (2) prevent vortex flows that might occur at the base of the sheet
piles as tidal water flows over the sill and that could potentially trap marine life; (3) protect the channel bed from scour in areas where existing sediments could be easily mobilized; and (4) provide additional lateral support for the sheet pile wall.

Short earthen embankments that wrap around the ends of the sheetpile would be used to attach the sill structure to the railroad embankment. These embankments would provide “closure” between the end of the sheetpile and the UPRR embankment. Because the materials used to construct the earthen embankments would be susceptible to erosion from wave action, a layer of riprap (likely a 0.5-foot thick layer of 6-inch riprap) would be placed at the location where the earthen embankment attaches to the UPRR embankment. An additional 2-foot thick, 10-foot wide apron of riprap would be placed between the rockfill buttress and the embankment (i.e., extending into the channel) where tidal flows are more likely to prevent scour adjacent to the remaining portion of the exposed sheet pile. The riprap apron would also extend to the UPRR bridge abutments to protect the banks between the sill structure and the bridge abutments against scour induced by potential vortices that may form as tides flow from Elkhorn Slough into Parsons Slough.

Construction of earthen embankment would require that an existing drainage along the western edge of the UPRR embankment be rerouted. About 50 linear feet of the drainage would be filled, and a small swale (12 feet wide by 80 feet long) would be excavated north and parallel to the new berm to allow drainage to continue to flow into the Parsons Slough Channel.

It is anticipated that construction of the sill would require placement of a maximum of 2,000 cubic yards (CY) of fill (rock, sheet pile), would cover up to 0.75 acres of subtidal habitat in the Parsons Slough Channel, and would permanently fill about 0.05 acre of salt marsh habitat.

**Temporary Disturbance Buffer**

A 20-foot disturbance buffer is included around the footprint of the sill to account for disturbance of sediment and vegetation during installation of the sheet pile, rockfill buttress, and/or riprap components of the sill structure. The 20-foot buffer includes about 0.21 acre of intertidal mudflat/subtidal channel and 0.10 acre of salt marsh habitat. Upon completion of the proposed project and after construction equipment and displaced materials are removed, temporarily disturbed areas will be allowed to return to pre-construction vegetated conditions.

**Boater Safety**

Signage indicating that the Parsons Slough Channel continues to be off-limits to boaters would be replaced at the ESNERR property boundary, which is located at the confluence of the Parsons Slough Channel and the main Elkhorn Slough channel (over the past several years, signs in this location have been inadvertently removed or damaged by weather and/or vandalism). A marked buoy or floating sign indicating that the channel is off limits to boaters would be positioned in the center of the Parsons Slough Channel in this area and signage would be replaced along the banks. Two additional buoys or similar features would be placed about 50 to 100-feet downstream of the sill to provide boaters with ample warning of the location of the sill. These features would deter boaters from approaching the structure during construction and would make boaters aware of an underwater structure and potential hazard. Finally, a sign indicating that a submerged structure is present would be mounted on the sill, above the high tide level.
**Sill Maintenance**

It is anticipated that maintenance activities typically would involve inspection and replacement of soil and dislodged rock armor on the earthen embankments. It is also anticipated that the rockfill buttress adjacent to the sheet pile may subside or settle over time. Every two to five years, ESNERR would use divers to inspect the rockfill buttress to assess if settlement of the rock has resulted in conditions that could prevent fish from entering Parsons Slough (e.g., rocks have subsided to the point that their slope no longer guides fish over the sill). If that condition were identified during the inspection, ESNERR would coordinate with the appropriate regulatory and resource agencies to consider adding additional rock riprap in the vicinity of the vertical face of the sill. Rock would only be added to raise the rock buttress to an elevation necessary to provide a ramp that would enable proper fish passage, and would not be raised higher than the elevation described in this Initial Study. Any requirements for additional environmental analysis (CEQA) or compliance (e.g., Clean Water Act compliance) would be determined during consultation with regulatory and resource agencies.

**Olympia Oyster Restoration**

The Olympia oyster is a native species of oyster limited almost entirely to estuaries along the Pacific Coast of North America. Their numbers have declined greatly in the past century due to habitat loss, poor water quality, over harvesting, sedimentation, and introduction of non-native predators and competitors. The current Elkhorn Slough population size is estimated at 5,000 to 10,000 individuals. To the south of Elkhorn Slough, the next known Olympia oyster population is in Mugu Lagoon, Ventura County; to the north, the next population is in San Francisco Bay. The Elkhorn Slough population of Olympia oysters, evident in the archaeological record for the past 10,000 years, provides connectivity between northern and southern California populations and supports ecosystem functions typically associated with healthy oyster beds, including improved water quality and shoreline protection, and increased fish and invertebrate diversity.

Recent monitoring efforts by ESNERR have found that Parsons Slough and the Azevedo wetland complex (about 0.5 miles north of Parsons Slough) currently support some of the densest adult oyster populations on available hard substrates within Elkhorn Slough, and the highest recruitment rates in the estuary. It is estimated that the oyster population in the Parsons Slough Complex represents about 10 percent of the population in the larger Elkhorn Slough Estuary, or 500 to 1,000 individuals. Total oyster populations in these areas are relatively small because very few hard substrates, which help oysters avoid burial in the mud, are available for oyster recruitment. The proposed Olympia oyster restoration effort would address this limiting factor by creating new hard substrate for the oysters to populate, with the long term goal of doubling the current population of oysters in the Parsons Slough Complex.

Up to ten reefs would be constructed by ESNERR staff and volunteers and placed in the northeastern portion of the Parsons Slough Complex (Figure 2). Each reef would be composed of several modular sections, each of which would be about 5 feet long, 2 feet wide, and a half foot tall. As many as 6 modular sections could be assembled together to create a reef up to 30 feet long. The reefs would remain modular and mobile (i.e., modular sections would not be permanently attached to each other) to allow for adjustment of their position vertically (along the tidal gradient) and horizontally (along the shoreline). Adjustments may be required to optimize oyster recruitment; decrease cover by fouling, non-native species; and/or prevent burial by muddy sediments. Annual monitoring of oyster recruitment and survival would inform the adaptive management of reef position.
Reef modules would be constructed of a mix of large, native clam shells secured in a matrix of cement made from local estuarine sediment. Clam shells would be harvested from sites near the mouth of the Elkhorn Slough estuary where sea otters forage and dispose of clam shells. Collection sites have already been specified in a Scientific Collecting Permit issued by CDFG to ENSERR and include locations at Moss Landing State Beach and in Vierras, south of the Highway 1 bridge. The local sediment to be used for creating the cement backbones of the reefs would be collected from the same sites as where the oyster reefs would be placed. Only the minimal amount of sediment necessary to secure the clam shells in place would be used (e.g., less than 5 CY of mud at each site). All sediment would be collected by hand to ensure minimal disturbance of surrounding habitat. The sediment borrow site would be recontoured after sediment removal using a hand tool to ensure that no depressions remain.

Prior to placement in the Parsons Slough Complex, each reef would be cured for up to two months to minimize the potential for the cement component to degrade once in the water column. Based on a smaller pilot project completed in 2008 (Wasson pers. comm. 2010a), it is anticipated that reefs would be placed between 1 and 2 feet above mean lower low water (MLLW) at up to 10 sites within the large area depicted in Figure 2.

**Project Construction Activities and Schedule**

**Overview**

The proposed sill would be constructed using barges made up of flexi‐floats assembled at Kirby Park (see Staging Area below). The size of barges used for the work could be on the order of 40 feet wide by 60 to 80 feet long, set up to support a 90 ton crane with at least a 2 CY bucket. To minimize the potential for new, non‐native invasive species to be introduced to Elkhorn Slough, all barges will be cleaned before they are placed in the water.

A new, temporary floating dock and boat ramp would be constructed at the south end of Kirby Park to provide access to barges, which would then be floated to the proposed project construction site at the mouth of Parsons Slough. The distance between the staging area and the project site is approximately 2 miles. A main barge would be used for placement of fill materials and for driving the sheet piles and end bearing piles. Vibratory hammers would be used to set the sheet pile. Both vibratory and impact hammers may be used to set end bearing piles.

Reefs for the oyster restoration project would be staged from pick‐up trucks on the South Marsh Loop Trail and hauled down to the mudflats. They would be installed by hand by staff and volunteers associated with ESNERR. Temporary disturbance to the mudflats would be limited to the minimal foot traffic necessary to haul and assemble the reefs in place on the mudflats.

Interpretive signs describing the purpose of the proposed project and the anticipated benefits would be posted both at Kirby Park and near the proposed sill site, either at the mouth of Parsons Slough Channel, or closer to the UPRR bridge. Additional notification (e.g., posters) would be placed at Kirby Park describing the nature and anticipated length of construction impacts, and providing members of the public with information on alternative recreational areas and points of contact for additional information about the project.

**Staging Area**

Project staging would occur at Kirby Park, which is located in the upper portions of Elkhorn Slough, about 2 miles from the proposed sill site. Kirby Park was selected as the staging area for the proposed project because it is accessible both by water and via Elkhorn Road, has a paved parking area and boat ramp that can be used to
safely store equipment and access the water, and because it is located on the east side of the Highway 1 bridge. A staging area in Moss Landing Harbor was eliminated from consideration because barges loaded with equipment would not be able to pass under the Highway 1 bridge’s low clearance.

Figure 4 depicts proposed improvements at Kirby Park to facilitate project staging. During construction, the southern two-thirds of the parking area (about 0.5 acre) would be fenced off from the northern third (about 0.2 acre) to provide access to temporary office facilities and a stockpile area for storing and transferring construction materials to the worksite. Staging at Kirby Park would also require construction of three temporary floating docks, as described below and depicted in Figure 4:

- Construction of a temporary dock that would be used to load barges. The dock would be either a pile-supported dock outfitted with a crane to load barges, or a dock constructed on temporary rock-fill that would allow front end loaders to transport equipment and material from the staging area directly onto barges. A pile-supported dock would be approximately 40-feet wide by 80-feet long and would consist of “I” beams and crane mats supported on piles installed on a 10 foot by 10 foot grid. Up to 45 piles may be required to support this dock. A rock-fill dock would be approximately 40-feet wide by 50-feet long and would require temporary placement of up to 350 CY of rock material, constructed at a gradual slope leading to the adjacent channel. The type of dock constructed would be determined by the construction contractor based on cost and current site conditions.

- Construction of a 10-foot wide by 100-foot long floating dock for tying off push boats necessary for barge movement. This dock would be tied to the existing concrete piles near the existing boat ramp on the south side of Kirby Park.

- Construction of a 10-foot wide by 40-foot long floating dock, and a 10-foot wide gravel boat ramp, for use by the public during construction activity. This temporary dock would be held in place with two end-bearing piles that would be removed when the dock and boat ramp are disassembled. The boat ramp and dock would be installed at Kirby Park before access to the existing boat ramp is limited by construction.

A crane or excavator would also be set up to assist in loading material onto barges, and loaders would be used to move materials around the staging area. Other equipment that would be used during construction include push boats, material barges, loading cranes, barge mounted cranes, loaders, and highway dumps.

**Restoration of Kirby Park Staging Area**

For many years, the paved portion of the Kirby Park parking lot adjacent to Elkhorn Slough has been eroding, due in large part to the position of the parking area relative to the flow of water at high tide. Kirby Park is located near a relatively sharp turn in the channel of Elkhorn Slough, allowing for flow and wind fetch to impinge directly on the edge of the paved area. As salt marsh in northern Elkhorn Slough has died back, the width of the open water area at high tide has more than doubled, further increasing fetch and wave height. Land subsidence has also contributed to the erosion.

It is anticipated that restoring the portions of the paved area impacted during construction by simply replacing the disturbed area with new asphalt would be ineffectual, and may possibly exacerbate erosion in the area. As a result, to maintain the long-term functionality of the parking area, reduce hazards to people using the parking lot, and minimize the potential for erosion in the future, at locations temporarily disturbed during construction, ESNERR would remove the portions of degraded pavement, recontour those areas for a more appropriate...
transition to intertidal mudflat, and install large rocks to protect the bank and minimize future erosion. Improvements would be confined to the portion of the parking area that was either paved or covered by remaining, intact gravel roadbase prior to construction activities, and that is located above mean high water (MHW) (4.8 feet); placement of rock would not extend into the adjacent intertidal mudflat. This effort would impact an area approximately 400 feet long and 5 to 10 feet wide, and would result in a minimal reduction in the paved area available for parking at Kirby Park. Figure 4 illustrates where these permanent improvements would be made.

All other areas temporarily disturbed at Kirby Park during construction would be returned to pre-construction conditions.

**Construction Sequencing**

The general approach for sequencing construction of the sill would be as follows:

- The construction contractor would mobilize and prepare the staging area at Kirby Park, assemble the barges, and prepare the project site by placing temporary mooring piles both at the Kirby Park staging area and at the sill construction site.
- The UPRR embankment tie-ins would be constructed and sheet pile would be placed between the end of the tie-ins and the edge of Parsons Slough Channel.
- End bearing piles would be placed in the channel, as would the remaining portions of the sheet pile, starting from the edge of the channel working toward the center.
- The rockfill buttress would be placed adjacent to the sheet pile in the channel.
- All temporary construction materials and facilities would be removed, and areas temporarily disturbed would be returned to pre-construction conditions.

Construction would primarily occur during slack tide to prevent barges from being manipulated by tidal currents, although the construction contractor may operate during other tidal cycles depending on site conditions and the nature of the construction activity. It is anticipated that construction would last 11 to 15 weeks. During that time, pile driving would occur during a 6 to 10 consecutive week period. This construction period assumes that the construction contractors could work up to 24 hours a day, 6 days a week. It is anticipated that night-time construction activities would occur for approximately 20 non-consecutive nights.
9. Setting and surrounding land uses:

The proposed project is located in the greater Elkhorn Slough estuary, situated 90 miles south of San Francisco and 20 miles north of Monterey. Parsons Slough is an arm of Elkhorn slough, which is a shallow estuary extending from Monterey Bay at Moss Landing Harbor inland (east) for approximately 4 miles and then north for another 3.1 miles. Elkhorn Slough has an average depth of 4.6 feet, and is deepest at the Highway 1 bridge overcrossing where it measures 25 feet deep at MLLW. The main channel in Elkhorn Slough becomes narrower and shallower as it winds inland. Like many estuaries, Elkhorn Slough consists of a complex mix of channels, mudflats, marshes, and small tidal creeks.

Surrounding Elkhorn Slough are the hilly uplands and marine terraces that lie between the Pajaro and Salinas Valleys. Upland areas drain into Elkhorn Slough through Carneros Creek at the head of the estuary and through numerous small ephemeral creeks. Land use in these uplands consists of agriculture (primarily strawberries and other row crops), cattle grazing, rural residences, and the small town of Las Lomas.

Wetlands, mudflats, and marsh areas on both sides of Parsons Slough characterize the immediate project setting. Uplands surrounding Parsons Slough are primarily undeveloped, as the ESNERR-managed area consists of 1,694 acres that are protected for long-term research, water quality monitoring, education, and coastal stewardship (ESNERR 2006).

North County Monterey High School and Elkhorn Elementary School are located approximately 1.75 miles southeast of the proposed sill location.

Other public agencies whose approval may be required:

The Elkhorn Slough Estuary is managed by a partnership of state, federal, and non-profit partners, and includes three State Marine Reserves, a State Ecological Reserve and Wildlife Management Area, a National Estuarine Research Reserve, and is part of a National Marine Sanctuary.

Approval from the following Federal agencies may be required to implement the proposed project:

- U.S. Army Corps of Engineers (USACE): A Section 404 Clean Water Act (CWA) permit and a Section 10 Rivers and Harbors Act (RHA) permit would be required for placement of dredge or fill material into waters of the United States and work within navigable waters, respectively. The U.S. Environmental Protection Agency (EPA) has oversight responsibility for CWA permits.

- U.S. Coast Guard (USCG): A Section 9 RHA permit may be required to construct the sill in Parsons Slough Channel and/or work adjacent to Kirby Park if the USCG determines these waters to be “navigable”.

- National Marine Fisheries Service (NMFS): Federal Endangered Species Act (ESA) compliance would be required for potential effects on anadromous fish species federally-listed as threatened or endangered and for compliance with the Marine Mammal Protection Act (MMPA).

- U.S. Fish and Wildlife Service (USFWS): ESA compliance would be required for potential effects on wildlife and resident aquatic species federally-listed as threatened or endangered, as well as compliance with the MMPA.

- Monterey Bay National Marine Sanctuary: A Monterey Bay National Marine Sanctuary Permit would be required for construction activities within the boundary of the Sanctuary.
Approval from the following State and local agencies may be required to implement the proposed project:

- **California Coastal Commission, Central Coast District**: A Coastal Development Permit would be required for development activities within California’s coastal zone. Application for this permit would likely be considered by the CCC, rather than Monterey County (the local jurisdiction with an approved Local Coastal Program) due to the fact that a portion of the proposed project is located within areas where the CCC has retained jurisdiction.

- **Central Coast Regional Water Quality Control Board (RWQCB)**: Several permits would be required from the RWQCB including a Storm Water General Permit for Construction Activities in accordance with Section 402 of the CWA; Water Quality Certification in accordance with Section 401 of the CWA; and Waste Discharge Requirements in accordance with the Porter-Cologne Water Quality Control Act.

- **California Department of Fish and Game (CDFG)**: A Lake or Streambed Alteration Agreement, in accordance with Section 1602 of the California Fish and Game Code, would be required for work within the bed, channel or bank of Parsons Slough. CDFG is also a landowner and co-manager of ESNERR and is acting as the State lead agency under CEQA.

- **California State Lands Commission (SLC)**: The SLC has jurisdiction over California’s “sovereign lands,” including tidelands and submerged lands; however, due to the specific land ownership and management of lands in Elkhorn Slough, the SLC has determined that no authorization for the proposed project is required from their agency (Connor pers. comm. 2010).

- **Moss Landing Harbor District**: A Construction Permit from the Moss Landing Harbor District would be required for all construction activities in Elkhorn Slough. Kirby Park is also owned and managed by the Moss Landing Harbor District, so use of Kirby Park as a staging area would require approval from the Harbor District.

- **Monterey County**: A grading permit from Monterey County would be required for construction of the proposed project. Monterey County would also be responsible for coordinating coastal permitting responsibilities with the CCC.

Other public agencies with jurisdiction over the proposed project may include:

- **California State Historic Preservation Office (SHPO)**: Section 106 of the National Historic Preservation Act (NHPA), as codified in 36 Code of Federal Regulations (CFR) 800.4, requires federal agencies to consult with the SHPO on potential effects to resources that are eligible for listing as historic resources.
### B. ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a “Potentially Significant Impact” as indicated by the checklist on the following pages.

| [X] Aesthetics | [ ] Agriculture Resources | [ ] Air Quality |
| [X] Biological Resources | [X] Cultural Resources | [X] Geology / Soils |
| [ ] Hazards/Hazardous Materials | [X] Hydrology / Water Quality | [ ] Land Use / Planning |
| [ ] Mineral Resources | [X] Noise | [ ] Population / Housing |
| [ ] Public Services | [X] Recreation | [ ] Transportation/Traffic |
| [ ] Utilities / Service Systems | [ ] Mandatory Findings of Significance |

Some proposed applications that are not exempt from CEQA review may have little or no potential for adverse environmental impact related to most of the topics in the Environmental Checklist, and/or potential impacts may involve only a few limited subject areas. These types of projects are generally minor in scope, located in a non-sensitive environment, and are easily identifiable and without public controversy. For the environmental issue areas where there is no potential for significant environmental impact (and are not checked above), there is no potential for significant environmental impact to occur from construction or maintenance of the proposed project. This finding can be made using the project description, environmental setting, or other information as supporting evidence, which is provided in the Environmental Checklist below. For those environmental issue areas where there is potential for significant environmental impact (checked above), mitigation measures have been identified in this document that would reduce impacts to a less than significant level.
C. LEAD AGENCY DETERMINATION
On the basis of this initial evaluation:

[ ] I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

[X] I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

[ ] I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

[ ] I find that the proposed project MAY have a “potentially significant impact” or “potentially significant unless mitigated” impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

[ ] I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

________________________   _______________________
Signature                      Date

Jeffrey R. Single, PhD
Printed name                   Regional Manager
Title
D. EVALUATION OF ENVIRONMENTAL EFFECTS

The Environmental Checklist and discussion that follow are based on sample questions provided in the CEQA Guidelines (Appendix G of the California Code of Regulations, Title 14, Division 6, Chapter 3), which focus on various individual concerns within 16 different broad environmental categories, such as air quality, cultural resources, land use, and traffic (and arranged in alphabetical order). The Guidelines also provide specific direction and guidance for preparing responses to the Environmental Checklist. Each question in the Checklist essentially requires a “yes” or “no” reply as to whether or not the project will have a potentially significant environmental impact of a certain type, and, following a Checklist table with all of the questions in each major environmental heading, citations, information and/or discussion that supports that determination. The Checklist table provides, in addition to a clear “yes” reply and a clear “no” reply, two possible “in-between” replies, including one that is equivalent to “yes”, but with changes to the project that the proponent and the Lead Agency have agreed to that result in a “no” reply; and another “no” reply that requires a greater degree of discussion, supported by citations and analysis of existing conditions, threshold(s) of significance used, and project effects resulting in a “no” reply. Each possible answer to the questions in the Checklist, and the different type of discussion required, are discussed below:

A. Potentially Significant Impact. Checked if a discussion of the existing setting (including relevant regulations or policies pertaining to the subject) and project characteristics with regard to the environmental topic demonstrates, based on substantial evidence, supporting information, previously prepared and adopted environmental documents, and specific criteria or thresholds used to assess significance, that the project will have a potentially significant impact of the type described in the question.

B. Less Than Significant With Mitigation. Checked if the discussion of existing conditions and specific project characteristics, also adequately supported with citations of relevant research or documents, determine that the project clearly will or is likely to have particular physical impacts that will exceed the given threshold or criteria by which significance is determined, but that with the incorporation of clearly defined mitigation measures into the project, that the project applicant or proponent has agreed to, will be avoided or reduced to less-than-significant levels.

C. Less Than Significant Impact. Checked if a more detailed discussion of existing conditions and specific project features, also citing relevant information, reports or studies, demonstrates that, while some effects may be discernible with regard to the individual environmental topic of the question, the effect would not exceed a threshold of significance, which has been established by the Lead or a Responsible Agency. The discussion may note that due to the evidence that a given impact would not occur or would be less than significant, no mitigation measures are required.

D. No Impact. Checked if brief statements (one or two sentences) or cited reference materials (maps, reports or studies) clearly show that the type of impact could not be reasonably expected to occur due to the specific characteristics of the project or its location (e.g., the project falls outside the nearest fault rupture zone, or is several hundred feet from a 100-year flood zone, and relevant citations are provided). The referenced sources or information may also show that the impact simply does not apply to projects like the one involved. A response to the question may also be "No Impact" with a brief explanation of adequately supported project-specific factors or general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a basic screening of the specific project).
The discussions of the replies to the Checklist questions must take account of the whole action involved in the project, including off-site as well as on-site effects, both cumulative and project-level impacts, indirect and direct effects, and construction as well as operational impacts. Except when a “No Impact” reply is indicated, the discussion of each issue must identify:

a) the significance criteria or threshold, if any, used to evaluate each question; and

b) the mitigation measure identified, if any, to reduce the impact to less than significant, with sufficient description to briefly explain how the mitigation measure would reduce the effect to a less than significant level.

Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration (Section 15063(c)(3)(D) of the Guidelines). In this case, a brief discussion should identify the following:

a) Earlier Analysis Used. Identify and state where they are available for review.

b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures, which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the proposed project.
E. EVALUATION OF ENVIRONMENTAL IMPACTS

I. AESTHETICS

<table>
<thead>
<tr>
<th>Would the project:</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Have a substantial adverse effect on a scenic vista.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>c) Substantially degrade the existing visual character or quality of the site and its surroundings.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Comments:

Parsons Slough is part of the scenic Elkhorn Slough complex, which is characterized by channels, wetlands, and surrounding open space and agriculture. At high tide, much of Parsons Slough appears as open water surrounded by agricultural and protected undeveloped areas dominated by grasses and trees. At lower tides, much of the slough is characterized by mudflats, tidal channels, and areas of wetland and marsh vegetation. Other features visible in and around the project area include trails, levees, culverts, overhead power lines, and support towers.

No residences are situated near the proposed sill site. A few scenic overlooks are located along hiking trails in the surrounding uplands. The trails of the Elkhorn Slough National Estuarine Research Reserve are open to the public and are extensively used. The nearest point on a public trail or scenic overlook is 0.37 miles away from the proposed site sill. A system of trails/boardwalks winds around the South Marsh shoreline, providing views of the proposed oyster restoration sites.

Railway passengers also have views of the slough and surrounding areas from passenger trains using the UPRR tracks through Elkhorn Slough, including those directly adjacent to the proposed sill site. Several passenger trains pass through the project area each day. The proposed staging area at Kirby Park provides views of the larger Elkhorn Slough. The staging area itself is a paved parking lot with public access facilities (boat ramp and temporary bathroom stalls).

For the purposes of this Initial Study, the significance of visual impacts is assessed in terms of the existing visual context of the project area, and the proposed intensity of the changes to that visual context. The visual context reflects the aesthetic character of the area, and includes identifying sensitive visual receptors (such as parks, recreation areas, scenic highways, and trails) and potential public viewpoints. Evaluating the intensity of the potential change in the visual context includes an assessment of the size, scale, and character of the changes, and their aesthetic consistency or conflict with the existing surrounding landscape.
a – c) Monterey County has designated three scenic routes in the region: Highway 1, Highway 156, and portions of Elkhorn Road. Neither the proposed sill site nor the proposed staging area at Kirby Park are visible from these three scenic routes. The sill site is not visible from any of the main roads in the area. Potential visual impacts associated with construction of the proposed project, as well as its long-term operation, are described below.

**Construction Impacts**

During sill construction, some views of Parsons Slough and Elkhorn Slough from kayaks and surrounding vistas would be partially altered by barges and cranes. Construction activities would also be visible from trails around Elkhorn Slough. Similarly, project construction would temporarily affect scenic views from the Kirby Park staging area, which would change from a parking lot with cars to a storage area covered with construction equipment, sheet piles, and rock. This impact on visual resources would be temporary (3 to 4 months) and the staging area would be restored to pre-project conditions after project construction is complete. Construction of the artificial oyster reefs would be visible from the South Marsh loop trail; however, construction would be of short duration (several days), would affect a small area (a total of 300 linear feet or 0.01 acre), would occur only at low tides, and would involve no heavy equipment (reefs staged by hand). As a result, visual impacts during project construction are considered *less than significant*.

**Operational / Long-Term Impacts**

Once installed, a total of 170-foot length of sheet pile and associated structure would be visible to boaters. This section would rise above the water to a height 1.8 feet above the adjacent UPRR railroad embankment, and approximately 1.5 feet below the guard rails on the adjacent UPRR railroad bridge (approximately 9.8 feet above NAVD88). Figure 5 shows a plan view of the proposed new sill structure at mean low tide, including the 170 feet of sheetpile and earthen embankment that would be visible from the surrounding area. The portions of the permanent structure that would be visible would be of similar color and visual character to the existing bridge structure. Figure 6 provides a generalized simulation of pre- and post-project views at mean low tide of the UPRR bridge / proposed sill structure from a kayaker’s perspective (i.e., at water level), looking east from Elkhorn Slough towards Parsons Slough.

As described above, the proposed sill has been designed to accommodate about 1.6 feet of sea level rise over time. The visual impact of the sill would be reduced over time as the water level rises and conceals the structure.

Figure 7 provides view of the proposed oyster reef sites. Artificial oyster reefs would appear initially as light-colored linear features on the intertidal mudflats of the Parsons Slough complex. Over time, those features would be colonized with oysters that are similar in color to the surrounding mudflat and therefore would be less visible from the adjacent uplands.

**Trail Users**

As can be seen in Figure 6, the visible portion of the proposed sill structure would be similar in scale and materials to the adjacent bridge structure and, from most locations, would not block views of the UPRR tracks or the entrance to Parsons Slough. While the sill structure would change the view from the water, it would not change the view significantly. The sill structure would most likely appear as an extension/expansion of the existing bridge structure. As such, it would add to this existing “structural” component of the views of this site.
Because the sill would be located about 0.37 miles from the nearest trail system, the structure would be difficult to distinguish from existing infrastructure without a spotting scope.

The artificial oyster reefs would be constructed in an area characterized by narrow fingers of water surrounded by low hills; some long linear channels can be seen in the western portions of the slough. The oyster reefs would be visible primarily at low tides, from the trails to the north and west of the Visitors Center. Although the linear reefs would represent an artificial component in the landscape, as they become colonized with oysters over time, they would gradually blend in visually with the surrounding substrate. Due to their low profile and their limited exposure primarily at low tides, the reefs would not constitute a substantial intrusion in most views. Therefore, the project’s visual impact to trail users is considered less than significant.

**Train Passengers**

Portions of the sill above the surface of the water would also be visible from the UPRR tracks by some train passengers as they travel through the project area. From the train, the sill abutments would likely be visible for less than a minute as the train passes over the Parsons Slough Channel. These structures would likely appear as an additional infrastructure feature of the UPRR bridge, or as an extension of the existing railroad embankment in near-field views. The project facilities may or may not be perceived as having a visual interest; however, because of their very close proximity to the railroad tracks, the proposed sill would only be visible for a very short period compared with views of more distant aspects of the slough. As such, the sill structures would not be prominent in, or otherwise substantially affect, the overall vistas of the slough from the train.

In addition, new infrastructure associated with the sill would not be unusual in Elkhorn Slough. Similar water control structures are visible in close proximity to the railroad tracks at the mouths of four other tidal channels in Elkhorn Slough. Other infrastructure, including power poles, wildlife observation blinds, and instrument platforms, are also visible in close proximity to the UPRR tracks and proposed sill location. Numerous electrical transmission towers are visible at a distance of one-half mile.

In consideration of the limited duration train passengers would be exposed to the sill infrastructure (less than one minute), the close proximity of the sill to other infrastructure (UPRR embankment, power poles, wildlife observation blinds), and the limited impact the sill would have on overall vistas of Parsons and Elkhorn Slough, the project’s visual impact to railroad passengers traversing the project area is considered less than significant.

The proposed oyster reefs would be located in slough fingers distant from the railway, would be low-lying and covered by water except at low tides, and are therefore unlikely to be visible to train passengers.

**Watercraft**

Monterey County considers Elkhorn Slough an official “Scenic Waterway;” however, watercraft in Elkhorn Slough are prohibited from entering the Parsons Slough Channel due to the sensitive nature of natural resources in this portion of the estuary. In the past, these restrictions have been displayed on signage near the confluence of the Parsons Slough Channel and Elkhorn Slough, but previous signs have been removed by weather and/or vandalism. As part of the proposed project, these signs would be replaced at the confluence of Parsons Slough Channel and Elkhorn Slough (about 800 feet downstream of the sill location) and additional buoys or similar features would be placed about 50 to 100-feet downstream of the sill to provide boaters with ample warning of the location of the sill. (see Boater Safety above),
Views of the sill structure from watercraft venturing up the mouth of Parsons Slough to the bridge would be composed of rock abutments and sheet piling rising out of the water. These features would be similar in size, scale and, to some degree, materials, to the existing railroad embankments nearby. Therefore, while the structure would change the view from the water, the visual impact would be less than significant.

Minor changes in water levels due to installation of the sill may also be apparent to some kayakers, trail uses, or train passengers with views of the project area, although such differences would be difficult for most observers to discern. Over the long term, some additional fringing wetland vegetation would appear in views of Parsons Slough. The proposed oyster reefs would be located in an area off limits to boaters and would not be visible. These changes in visual quality are not considered adverse and the impact is considered less than significant.

d) Project construction at the sill location may occur at night or in low light conditions. In this event, construction activities would require the use of lights. The introduction of light and glare at the sill location during slack tide would be considered a less than significant impact on visual resources because contractors would use limited directional lighting with minimal spillover for short periods of time. It is anticipated that night-time construction activities and the introduction of light to the area would last no more than approximately 20 non-consecutive nights (estimated number of night-time slack tide events that coincide with proposed construction window). Night-time construction and use of lights may be prohibited by USFWS if marine mammals occupy the area at night. In this event, the proposed project would not employ the use of lights and there would be no impact. This impact is further analyzed in the Biological Resources section of this Initial Study.

Any lighting impacts that may occur during construction activities would be temporary and would cease upon completion of the sill. Oyster reef construction would occur during daylight hours and no supplemental lighting would be needed for their construction. As a result, the proposed project would have a less than significant visual impact from light and/or glare.
Representative of visible portion of the sill structure, as seen from an aerial perspective, at mean low tide. Approximately 170 feet of sheetpile and erosion protection represented.
Representative of visible portion of the sill structure, as seen from the water, at mean low tide. Approximately 170 feet of sheetpile and erosion protection represented.
View of Proposed South Marsh Oyster Reef Site Looking North from South Loop Trail

View of Proposed South Marsh Oyster Reef Site from Wooden Pathway Looking South
II. AGRICULTURE AND FOREST RESOURCES

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state’s inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:

<table>
<thead>
<tr>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
</table>

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use.

b) Conflict with existing zoning for agricultural use, or a Williamson Act contract.

c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)) or timberland (as defined by Public Resources Code section 4526)?

d) Result in the loss of forest land or conversion of forest land to non-forest use?

e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use.

X

Comments:

a – e) Based upon a review of the Conservation Element, Map of Important Farmlands, and Map of Agricultural Preserves prepared by Monterey County, no impact would occur to agricultural resources because there is currently no Farmland, as defined by the California Resources Agency, within the proposed project area. The proposed sill location is not zoned for agricultural use or protected under a California Land Conservation (Williamson Act) contract. Farmland adjacent to the larger Elkhorn Slough would not be affected by the proposed project. Moreover, no forest lands are located within or adjacent to the project area and, as such, the project would not result in any direct loss of forest land or lands currently under timber preserve. Thus, no impact would occur to agriculture or forestry resources.
III. AIR QUALITY

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Conflict with or obstruct implementation of the applicable air quality plan.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>c) Result in a cumulatively considerable net increase of any criteria pollutant for which the 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).</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>d) Expose sensitive receptors to substantial pollutant concentrations.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>e) Create objectionable odors affecting a substantial number of people.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>f) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>g) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Comments:

a) If a project is proposed in a city or county with a general plan that is consistent with the most recently adopted air quality plan, and if the project is consistent with that general plan, then the project is considered to be consistent with applicable air quality plans and policies. The project area is located within Monterey County and the Monterey Bay Unified Air Pollution Control District (MBUAPCD). The MBUAPCD’s jurisdiction is the North Central Coast Air Basin (NCCAB), composed of Monterey, Santa Cruz, and San Benito counties. The most recently adopted air quality plan is the 2008 Air Quality Management Plan, which includes strategies for MBUAPCD to reach attainment for the State’s 8-hour ambient air quality standards (MBUAPCD 2008a). The Monterey County General Plan (Monterey County 2008) governs land use in the project area and recognizes the need to provide for growth and to maintain good air quality by taking proper actions to achieve desired standards of air quality (Monterey County 2007).

The proposed project would be consistent with the current land use designation for the project area within Monterey County (i.e., Resource Conservation [Coastal Zone]), and the General Plan is consistent with the strategies identified in the 2008 Air Quality Management Plan. The proposed project would not conflict with or
obstruct implementation of the applicable air quality plan and would have no impact on this environmental factor.

b) The NCCAB basin lies along the central coast of California and covers an area of 5,159 square miles. The semi-permanent high pressure cell in the eastern Pacific is the basic controlling factor in the climate of the air basin. In the summer, the generally northwest-southeast orientation of mountainous ridges tends to restrict and channel the onshore air currents. In the fall, the north or east winds develop to transport pollutants from either the San Francisco Bay area or the Central Valley into the NCCAB. The general absence of deep, persistent atmospheric inversions and the occasional storm systems usually result in good air quality for the basin as a whole in winter and early spring (MBUAPCD 2008b).

The proposed project could impact local pollutant concentrations in two ways. First, during project construction, the project would impact local particulate concentrations by generating dust. Construction would also generate some emissions from construction worker vehicles trips and construction equipment emissions. Over the long-term, mobile air pollutant sources associated with operation and maintenance of the proposed project components (e.g., boat trips to the sill location) could also impact local pollutant concentrations. These potential impacts are described below.

**Construction**

Dust generated during construction may result in emissions of particulate matter, including particulate matter less than 10 microns in diameter (PM10). The entire NCCAB is a nonattainment area for PM10 and a substantial increase in PM10 emissions would be considered a significant impact by the MBUAPCD.

Construction of the proposed project would involve use of equipment and materials that would temporarily generate dust and emit ozone precursor emissions (i.e., reactive organic gases [ROG] and nitrogen oxide [NOx]). Equipment used during construction would include a crane or excavator to assist in loading material onto barges, loaders to move materials around the staging area, and other equipment such as push boats, material barges, loading cranes, barge mounted cranes, pile drivers, loaders, highway dumps, and pick-up trucks. Fugitive dust (including PM10) and other criteria pollutants would be generated from the operation of marine vessels and heavy equipment (primarily diesel-operated), and construction worker vehicle trips (primarily gasoline-operated). Construction-related emissions would vary from day to day, depending on the level and type of activity and the weather.

According to the MBUAPCD’s CEQA Air Quality Guidelines, project-related construction activities that have the potential to disturb fewer than 8.1 acres with minimal grading, and 2.2 acres with major earthmoving, would not be expected to exceed the MBUAPCD’s PM10 threshold and would be considered less than significant. Neither major nor minor earthmoving activities at the project site would be expected to exceed these thresholds, because no grading or major earthmoving would occur and the sill site would cover a maximum of 0.75 acres, primarily under water. In addition, the MBUAPCD’s CEQA Guidelines establish a threshold of significance for PM10 related construction emissions of 82 pounds per day. Construction related volatile organic compound (VOC) and NOx emissions from typical construction equipment are accommodated in the emissions inventories of State- and federally-required air quality plans and are therefore not considered significant.

Construction air pollution emission have been modeled and the results are presented in Table III-1. Appendix A provides additional information regarding the air emission calculations, assumptions, and methodologies. As
shown in the table, construction emissions associated with the proposed project would be *less than significant* based on MBUAPCD significance criteria.

**Table III-1  Estimated Daily Construction Air Pollutant Emissions**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Criteria Air Pollutant (pounds/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Daily Project Construction Emissions</td>
<td>PM10 4</td>
</tr>
<tr>
<td>MBUAPCD Thresholds of Significance</td>
<td>PM10 82</td>
</tr>
</tbody>
</table>

PM10 = particulate matter less than 10 microns in diameter (fine particulate matter)

Assumptions:
- Construction Start and Length – September 2010 and 17 weeks
- Building Material – 2,000 cubic yards (CY) of fill consisting of rock and sheet pile
- Equipment List – cranes, excavator, loaders, highway dumps, pick-up trucks, push boats, and material barges

**Operations**

Operational emissions associated with the proposed project would be generated primarily from periodic maintenance inspections of the sill, where access would be provided by motor vehicle and small boat trips. Air emissions from marine vessels were calculated based on EPA’s Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data (EPA 2000). Summary results are presented in Table III-2, with detailed calculations provided in Appendix A. As shown in the table, operational emissions of criteria pollutants would be well below the MBUAPCD thresholds. These sources would not lead to further violations of the ambient air quality standards in the area. This impact would be *less than significant*.

**Table III-2  Estimated Motor Vehicle and Marine Vessel Air Pollutant Emissions**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Criteria Air Pollutant (pounds/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Emissions (2011)</td>
<td>ROG &lt;1  NOx 1  CO &lt;1  PM10 1  SO2 &lt;1</td>
</tr>
<tr>
<td>MBUAPCD Thresholds of Significance</td>
<td>137  137  550  82  150</td>
</tr>
<tr>
<td>Exceeds Thresholds?</td>
<td>No  No  No  No  No</td>
</tr>
</tbody>
</table>

ROG = Reactive Organic Gases; NOx = Oxides of nitrogen; CO = Carbon monoxide; PM10 = particulate matter less than 10 microns in diameter (fine particulate matter); SO2 = Sulfur dioxide

c) As discussed above, the proposed project would result in air pollutant emissions well below the MBUAPCD significance thresholds; therefore, the proposed project’s individual impact on regional air quality would be *less than significant*. For projects with less than significant individual impacts that are consistent with the adopted regional air quality plan, the CEQA Air Quality Guidelines state that the cumulative impact would also be less than significant (MBUAPCD 2008b).

d) As noted in b), the proposed project would not generate substantial pollutant concentrations and thus would not expose sensitive receptors to substantial pollutant concentrations. In addition, the nearest residence is approximately 4,500 feet southwest of the project site. As a result, there would be *no impact* on sensitive receptors.
e) The MBUAPCD defines odors as emissions of one or more pollutants that are a nuisance to healthy persons and may trigger asthma episodes in people with sensitive airways (MBUAPCD 2008b). The proposed project would have no odor-generating components; therefore, there would be no impact.

f) In 2006, California passed the California Global Warming Solutions Act of 2006 (Assembly Bill No. 32; California Health and Safety Code Division 25.5, Sections 38500, et seq., or AB 32), which requires the California Air Resources Board (CARB) to design and implement emission limits, regulations, and other measures, such that statewide greenhouse gas emissions will be reduced to 1990 levels by 2020.

California now recognizes seven greenhouse gases (GHG): carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) (California Health and Safety Code section 38505(g)), and nitrogen trifluoride (NF₃) (Senate Bill No. 104, Chapter 331). Carbon dioxide is the reference gas for climate change because it gets the most attention and is considered the most important GHG. To account for the warming potential of different GHGs, GHG emissions are quantified and reported as CO₂ equivalents (CO₂E). The effects of GHG emission sources (i.e., individual projects) are reported in metric tons/year of CO₂E.

State Bill 97, 2007 Statutes, Chapter 185, acknowledges that local agencies must analyze the environmental impact of GHG under CEQA. The Natural Resources Agency adopted the CEQA Guidelines Amendments on December 30, 2009. The Amendments will become effective on March 18, 2010. There is currently no plan, policy, or regulation adopted by Monterey County for the purpose of reducing GHG emissions; however, as part of the Conservation/Open Space Element of the draft 2007 General Plan, Monterey County has identified a potential policy stating that within 24 months of the adoption of the General Plan, Monterey County will develop a Greenhouse Gas Reduction Plan to reduce emissions by 2020 to the 1990 level. The hearing for the draft 2007 General Plan is anticipated to occur in April 2010 (Holm pers. comm. 2010). At a minimum, it is anticipated that the General Plan will establish an inventory of current emissions in the County and include an inventory of emissions as of 1990 (Monterey County 2007).

Because there is currently no adopted GHG threshold for Monterey County projects, for this analysis the project would be considered to have a significant impact if the project would be in conflict with the Assembly Bill No. 32 State goals for reducing GHG emissions. Four types of analyses are used in this Initial Study to determine whether the project could be in conflict with the State goals for reducing GHG emissions.

A. Identification of any potential conflicts with the recommended actions identified in the Assembly Bill No. 32 Draft Scoping Plan.

B. Evaluation of the relative size of the project. The proposed project’s GHG emissions are compared to the size of major facilities that are required to report GHG emissions to the State (i.e., emissions more than 25,000 metric tons per year of CO₂E)¹. The proposed project size is also compared to the estimated State greenhouse reduction goal of 174 metric tons per year of CO₂E by 2020. As noted above, the 25,000 metric ton annual limit identifies the large stationary point sources in California that make up 94 percent of the stationary emissions. If the project’s total emissions are below this limit, its total emissions are equivalent in size to the smaller projects in California that as a group only make up 6

¹The State of California has not provided guidance as to quantitative significance thresholds for assessing the impact of GHG emissions on climate change and global warming concerns. Nothing in the CEQA Guidelines directly addresses this issue.
percent of all stationary emissions. It is assumed that the activities of these smaller projects will not conflict with the State’s ability to reach Assembly Bill No. 32 overall goals. In reaching its goals, the CARB will focus upon the largest emitters of GHG emissions.

C. Evaluation of the basic energy efficiency parameters of the proposed project to determine whether its design is inherently energy efficient.

D. Evaluation of any potential conflicts with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHG.

With regard to Item A, the project does not pose any apparent conflict with the most recent list of the CARB early action strategies.

With regard to Item B, maximum project construction GHG emissions would be approximately 189 metric tons per year of CO₂E, and project operations would be approximately <1 metric ton per year of CO₂E (including emissions from vehicle and small boat trips) (Appendix A). Based on size, the project would not be classified as a major source of GHG emissions; operational emissions would be substantially less than one percent of the lower reporting limit of 25,000 metric tons per year of CO₂E.

When compared to the overall State reduction goal of approximately 174 million metric tons per year of CO₂E, the maximum GHG emissions for the project (<1 metric tons per year of CO₂E, or a negligible percentage of the State goal) are quite small and would not conflict with the State’s ability to meet the Assembly Bill No. 32 goals. Appendix A provides additional information regarding the GHG calculations, assumptions, and methodologies.

It should be noted that saline intertidal and subtidal environments have rarely been documented as a source of methane, as the availability of marine salts (sulfates) provide an abundant preferred terminal electron receptor. Levels of methane would be unlikely to change either as a result of construction activities or from expected water quality impacts.

With regard to Item C, there are, at a minimum, two elements of the design that are inherently energy efficient and keep the generation of GHG emissions to a minimum. First, as noted above, the project is very small in size and would not be considered a major source of GHG emissions. Second, the project is efficiently located within two miles of the staging area.

With regard to Item D, the project would not conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHG.

The review of Items A, B, C, and D indicate that the proposed project would not conflict with the State goals in Assembly Bill No. 32 and therefore, this impact would be less than significant.

g) As stated in f) above, the proposed project would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHG. This impact would be less than significant.
### IV. BIOLOGICAL RESOURCES

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 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 California Department of Fish and Game or U.S. Fish and Wildlife Service.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) 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 California Department of Fish and Game or US Fish and Wildlife Service.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>d) 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 wildlife nursery sites.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Background**

**Approach to Evaluating Biological Resources**

This section describes potential impacts that may occur to biological resources in the project area as a result of sill installation and maintenance activities, and the placement of artificial oyster reefs in the Parsons Slough Complex. This section also describes mitigation measures that would be implemented to offset potential impacts and describes the beneficial impacts of the sill structure on biological resources in Elkhorn Slough. A complete discussion of existing biological resources located within the project area and the surrounding Elkhorn Slough is provided in Appendix B of this document.
The results of this assessment are based on a review of relevant databases, species lists provided in Appendix 5 - Habitats and Species of the Elkhorn Slough National Estuarine Research Reserve Final Management Plan 2007-2011 (ESNERR 2006), and project-specific biological survey reports, as well as periodic site visits.

The following databases were searched to determine what special-status plant and wildlife species may have the potential to occur within and adjacent to the proposed project area:

- California Natural Diversity Database (CNDDB) for the U.S. Geological Survey (USGS) 7.5-minute Prunedale quadrangle, and the eight surrounding quadrangles (CDFG 2010); and
- U.S. Fish and Wildlife Service Threatened and Endangered Species Database (USFWS 2010a).

A list of Federally endangered and threatened species that may be affected by activities within Monterey County was requested from the USFWS Ventura Office. A comprehensive list of special-status plant and animal species with the potential to occur in the vicinity of the project area is provided in Tables 1 and 2 in Appendix B. Figures 2a and 2b in Appendix B depict special-status species occurrence data from CDFG’s CNDDB (CNDDB 2010) for the project area and within a 5-mile radius of the project area.

Direct and indirect impacts on existing biological resources were evaluated by comparing the quantity and quality of habitats present in the project area under existing conditions to anticipated conditions during construction and after installation of the sill and oyster beds. For this evaluation, direct impacts on biotic resources were assessed based on the potential for the species or their habitat to be disturbed during construction of the sill structure or placement of the oyster reefs. Direct impacts would include soil/sediment disturbance and loss of existing subtidal habitat features at the sill site. Direct impacts also include temporal disturbance to species, habitats or natural communities resulting from barge access to the sill site, construction vehicle access and travel to Kirby Park, staging activities, temporary lighting at the sill site during low light conditions, noise disturbance associated with pile driving, stockpiling of construction materials within the Kirby Park parking area, and general human presence in and around the project area during construction.

Indirect impacts typically occur after construction activities are completed. Indirect impacts on natural communities include alteration of habitat conditions outside the footprint of ground-disturbing activities. Indirect impacts to biological resources resulting from the proposed project may include a change in tidal prism, minor increases in residence time in Parsons Slough, conversion of up to eight acres of intertidal mudflat to subtidal habitat, conversion of up to one acre of intertidal mudflat to salt marsh, changes in dissolved oxygen (DO) levels in Parsons Slough, and a long term increase in fringe salt marsh vegetation throughout Elkhorn Slough. In addition, placement of a structure at the mouth of Parsons Slough may cause disruption of wildlife movement patterns.

**Biological Resources Background**

The Parsons Slough Complex is located on the southeast side of Elkhorn Slough (Figure 1) and consists of the 254-acre Parsons Slough and the 161-acre South Marsh Area. In the past, the Parsons Slough Complex was dominated by tidal salt marsh and tidal creeks. Changes in hydrology and land use, along with land subsidence, have significantly increased tidal exchange in Parsons Slough, resulting in increased scour of the slough and reduction in salt marsh habitat. Changes to Parsons Slough hydrology have also affected tidal exchange in the larger Elkhorn Slough system. Within the past 60 years, the proportion of habitat that is salt marsh relative to the amount that is mudflat in Elkhorn Slough has reversed as a result of tidal erosion and inundation of interior marsh areas. The tidal range also increased during this period, resulting in a decreased extent of subtidal...
habitat and an increased extent of intertidal mudflat. Currently there are approximately 800 acres of salt marsh and tidal creeks within Elkhorn Slough, 1,600 acres of mudflat, and 300 acres of tidal channels (Van Dyke and Wasson 2005).

The Parsons Slough Channel bottom ranges between elevation -10 to -14 feet in the area downstream of the UPRR bridge. Tides at the UPRR bridge and within the Parsons Slough Complex are approximately the same as that of the ocean, with a mean tide range of 5.6 feet (Moffatt & Nichol 2008). The spring tide range is 8.2 feet and the neap tide range is 3.0 feet (Broenkow and Breaker 2005 in Elkhorn Slough Tidal Wetland Project Team 2007). The velocity of tidal flows at the UPRR bridge are high enough to erode the soft clay silts in which the channel is formed. Tidal velocities measured in 2002 were 5.6 feet per second during ebb tides and 4.9 feet per second during flood tides (Moffatt & Nichol 2008).

Natural communities are communities that are dominated by species native to the area, and that are diverse, regionally uncommon, or of special concern to local, state, and federal agencies. Table IV-1 below displays the natural communities and acreages present within the project study area.

| Table IV-1  Natural Community in the Parsons Slough Complex |
|---------------------------------|----------------|
| Habitat Type                    | Acres          |
| Tidal Mudflat                   | 377.6          |
| Restricted Mudflat              | 10.4           |
| Fully Tidal Salt Marsh          | 33.5           |
| Restricted Salt marsh           | 3.2            |
| Fresh or Brackish Marsh/Channel | 0.6            |
| Subtidal Saltwater Channel      | 32.9           |
| Intertidal Saltwater Channel    | 0.3            |
| Impounded Fresh Water (Not Included) | 9.7         |
| **Total Acreage**               | **468.2**      |


The current distributions of these communities within Parsons Slough are depicted in Figure 8 and are based on an existing conditions report provided in the Final Parsons Slough Wetland Restoration Plan (Elkhorn Slough National Estuarine Research Reserve et al. 2010). Descriptions of these communities are provided in Appendix B.

Wasson and Woolfolk (2007) identified six native salt marsh plant species in the high marsh/upland ecotone in the Five Fingers area of the Parsons Slough Complex. These salt marsh species were pickleweed, salt marsh dodder (*Cuscuta salina*), salt grass (*Distichlis spicata*), alkali heath (*Frankenia salina*), fat hen (*Atriplex triangularis*), and fleshy jaumea (*Jaumea carnosa*). The ecotone also supports various native and non-native upland plant species.
EXISTING HABITAT TYPES WITHIN THE PARSONS SLOUGH COMPLEX

Parsons Sill Project

March 2010  Project No. 1157  Figure 8
Special-Status Species

For the purposes of this Initial Study, the term “special-status species” refers to all plants or animals listed as threatened, endangered, or proposed for listing under the Federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA); plants listed as rare under the California Native Plant Protection Act; plants considered by the California Native Plant Society to be “rare, threatened, or endangered in California”; species that meet the definition of rare or endangered under CEQA; animals fully protected in California; and nesting raptors protected in California. A more detailed explanation of each of these categories of special-status classifications is provided in Appendix B of this document.

Tables 1 and 2 in Appendix B provide a summary of the status, habitat requirements and potential for occurrence for each of the special-status species with potential to occur in the project area. These tables are a compilation of those species obtained from the CNDDB search results (Figures 2a and 2b in Appendix B), the USFWS species list for Monterey County and species lists provided in the Elkhorn Slough National Estuarine Research Reserve Final Management Plan 2007-2011 (CNDDB 2010; USFWS 2010; ESNERR 2006). In evaluating the occurrence potential of special-status species in the project area, biologists considered relevant literature, knowledge of regional biota, existing data from regional experts, and observations made during the field investigations as analysis criteria.

Special-Status Plants

There are no special-status plants within the Parsons Slough Project footprint. Salt marsh vegetation, dominated by pickleweed and salt grass, is found on the UPRR embankments and surrounding tidal marsh adjacent to the proposed sill location and adjacent to the paved parking lot at Kirby Park (northern and eastern areas adjacent to the paved parking lot). No special-status plants have been noted in either area. Intertidal mudflats near the sill site and Kirby Park do not support vegetation.

The larger Elkhorn Slough estuary does contain sensitive aquatic species such as eelgrass (Zostera marina), which is concentrated in the main channel of Elkhorn Slough. Eelgrass provides important habitat for southern sea otters and a wide variety of invertebrate and fish species. Although there is no eelgrass located at the sill site location or in the Parsons Slough channel, the reduced tidal prism that would result from project implementation could cause an increase in eelgrass populations in Elkhorn Slough by decreasing the erosion of its substrate.

Special-Status Wildlife

The region currently supports a variety of vegetation communities and aquatic habitats that are essential for the dispersal, refuge, breeding, and foraging activities of common and special-status wildlife species. The USFWS and CNDDB database searches identified 46 special-status wildlife and fish species that may potentially occur in the project region. Table 2 in Appendix B includes a summary of the special-status wildlife species with potential to occur in the region and the reason each species would or would not occur in the project area.

The following special-status species, or potential habitat for these species, may be affected by the proposed project:

- California brackish water snail (=mimic tryonia) (Tryonia imitator) (no Federal or State listing status; locally rare);
- Olympia oyster (Ostrea lurida) (no Federal or State listing status; locally rare);
- Southern sea otter (*Enhydra lutris nereis*) (Federally listed as threatened, protected under the MMPA, and fully protected by the State); and
- Harbor seal (*Phoca vitulina*) (protected under the MMPA and no state listing).

Special-status fish species potentially occurring in the larger Elkhorn Slough include the Southern DPS of North American green sturgeon (*Acipenser medirostris*), tidewater goby (*Eucyclogobius newberryi*), and three listed salmonid species: coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawatscha*), and steelhead (*O. mykiss*). The potential for each of these species to occur within Elkhorn Slough in general, and within the proposed project area in particular, is considered very low.

In addition, Elkhorn Slough is recognized as a Globally Important Bird Area by the American Bird Conservancy. More than 265 bird species (73 percent of the California total) have been recorded in the Elkhorn Slough area. Most are seasonal visitors, but approximately 40 are year-round residents.

Aquatic birds — shorebirds, seabirds, herons, and waterfowl — account for much of the slough’s avian diversity. As one of the largest estuaries in California, Elkhorn Slough is a major stopover for birds migrating along the Pacific flyway. More than 20,000 sandpipers, plovers, and their relatives may be present at the peak of migration (Ramer et al. 1991). A number of these aquatic species nest in Elkhorn Slough, including great egrets, great blue herons, and double-crested cormorants. Caspian terns (*Sterna caspia*) nest on man-made islands in the area, and the federally-listed western snowy plover (*Charadrius alexandrinus nivosus*) is a known breeder in portions of the greater Elkhorn Slough. Eggs and nests of all birds are protected under Section 3503 of the California Fish and Game Code, as well as under the Federal Migratory Bird Treaty Act (MBTA). Both of these regulations are described in Appendix B of this document. The recently de-listed and State fully protected California brown pelican (*Pelecanus occidentalis*) also roosts in the open water habitat located in and adjacent to the project area.

**Comments:**

a) The project’s potential effects on special-status species and their habitats are discussed by species type below.

**Special-Status Species Plants**

As described above, there are no special-status plants within the Parsons Slough Project footprint, although some sensitive vegetation (salt marsh habitat) is located adjacent to the paved portions of Kirby Park and the proposed sill construction site. Implementation of Mitigation Measure IV-1 would minimize unintentional construction-related impacts to sensitive vegetation outside of the project area. This impact is considered less than significant with mitigation.

**Mitigation Measure IV-1.** The project applicant would implement the best management practices outlined in Table IV-2 to minimize stormwater runoff, erosion, and potential water quality impacts associated with construction activities. In addition, all contractors working in a capacity that could increase the potential for adverse water quality impacts (e.g., disturbance of soil at Kirby Park, maintenance of project equipment) shall receive training regarding the environmental sensitivity of the site and need to minimize impacts. Contractors also shall be trained in implementation of stormwater BMPs for protection of water quality.
### Table IV-2  Construction-Related Best Management Practices

<table>
<thead>
<tr>
<th>BMP ID</th>
<th>Name</th>
<th>BMP</th>
</tr>
</thead>
</table>
| BMP -1 | Erosion Control             | 1. Limit traffic speeds on unpaved roads to 15 mph.  
2. Install sandbags or other erosion control measures to prevent silt runoff to public roadways.  
3. Upland soils exposed due to construction activities will be seeded and stabilized using erosion control fabric or hydroseeding. Areas below the mean high water mark are exempt from this BMP.  
4. Erosion control fabric will consist of natural fibers that will biodegrade over time. No plastic or other non-porous material will be used as part of a permanent erosion control approach.  
5. Erosion control fabric will be anchored in place. Anchors can include U-shaped wire staples, metal geotextiles stake pins, or triangular wooden stakes.  
6. Other erosion control measures shall be implemented as necessary to ensure that sediment or other contaminants do not reach surface water bodies for stockpiled or reused/disposed sediments. |
| BMP -2 | Staging and Stockpiling of Materials | 1. All construction equipment will be staged within the paved portions of Kirby Park, the adjacent temporary docks, or on a barge. Within Kirby Park, all construction equipment and materials will be contained within the existing paved area.  
2. All construction-related items, including equipment, stockpiled material, temporary erosion control treatments, and trash will be removed within 72 hours of project completion. All residual soils and/or materials will be cleared from the project site.  
3. Building materials and other construction-related materials, including chemicals, will not be stockpiled or stored where they could spills into water bodies or storm drains, or where they could cover aquatic or riparian vegetation.  
4. No runoff from the project or staging areas may be allowed to enter water bodies or storm drains without being subjected to filtration (e.g., vegetated buffer, hay wattles or bales, silt screens). |
| BMP -3 | Spill Prevention and Response Plan | A Spill Prevention and Response Plan will be developed prior to commencement of construction activities, and will summarize the measures described below. The work site will be routinely inspected to verify that the Spill Prevention and Response Plan is properly implemented and maintained. Contractors will be notified immediately if there is a noncompliance issue.  
1. Equipment and materials for cleanup of spills will be available on site.  
2. All spills and leaks will be cleaned up immediately and disposed of properly.  
3. Prior to entering the work site, all field personnel shall be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills.  
4. Field personnel shall implement measures to ensure that hazardous materials are properly handled and the quality of water resources is protected by all reasonable means.  
5. Spill prevention kits shall always be in close proximity when using hazardous materials (e.g., crew trucks and other... |
6. Absorbent materials will be used on small spills located on impervious surfaces rather than hosing down the spill; wash waters shall not discharge to the storm drainage system or surface waters. For small spills on pervious surfaces such as soils, wet materials will be excavated and properly disposed of rather than buried. The absorbent materials will be collected and disposed of properly and promptly.

7. As defined in 40 CFR 110, a federal reportable spill of petroleum products is the spilled quantity that:
   - violates applicable water quality standards;
   - causes a film or sheen on, or discoloration of, the water surface or adjoining shoreline; or
   - causes a sludge or emulsion to be deposited beneath the surface of the water or adjoining shorelines.

If a spill is reportable, the contractor’s superintendent will notify ESNERR, and ESNERR will take action to contact the appropriate safety and cleanup crews to ensure that the Spill Prevention and Response Plan is followed. A written description of reportable releases must be submitted to the appropriate RWQCB and the California Department of Toxic Substances Control (DTSC). This submittal must contain a description of the release, including the type of material and an estimate of the amount spilled, the date of the release, an explanation of why the spill occurred, and a description of the steps taken to prevent and control future releases. The releases will be documented on a spill report form.

If an appreciable spill has occurred, and results determine that project activities have adversely affected surface water or groundwater quality, a detailed analysis will be performed to the specifications of DTSC to identify the likely cause of contamination. This analysis will include recommendations for reducing or eliminating the source or mechanisms of contamination. Based on this analysis, ESNERR or contractors will select and implement measures to control contamination, with a performance standard that surface and groundwater quality must be returned to baseline conditions. These measures will be subject to approval by ESNERR, DTSC, and the RWQCB.

<table>
<thead>
<tr>
<th>BMP ID</th>
<th>Name</th>
<th>BMP</th>
</tr>
</thead>
</table>
| BMP - 4 | Equipment, Vessel and Vehicle Maintenance | 1. All vessels, vehicles and equipment will be kept clean. Excessive build-up of oil or grease will be prevented.  
2. All vessels and equipment used in the Elkhorn Slough and Parsons Slough channels will be inspected for leaks each day prior to initiation of work. Action will be taken to prevent or repair leaks, if necessary.  
3. Vessel, vehicle, and equipment maintenance activities will be conducted in a designated area to prevent inadvertent fluid spills from adversely impacting water quality. To the extent possible, maintenance activities will be conducted at Kirby Park, or another off-site location, on impervious surfaces at least 50 feet away from surface waters. If maintenance must occur on-site (i.e., on barges or on land adjacent to the sill construction site), the area where maintenance will occur will be set up to ensure that spills or runoff are not able to discharge to surface waters. For maintenance activities that must occur on barges, barriers (e.g., sandbags, scupper blocks) will be placed over all overboard discharge locations to prevent the introduction of contaminants to adjacent water bodies. Maintenance activities that occur on land adjacent to the sill construction site shall be located in an area that prevents a direct connection to surface waters. This area will be clearly designated with berms, sandbags, or other barriers. |
<table>
<thead>
<tr>
<th>BMP ID</th>
<th>Name</th>
<th>BMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4. Secondary containment, such as a drain pan or drop cloth, to catch spills or leaks will be used when removing or changing fluids. Fluids will be stored in appropriate containers with covers, and properly recycled or disposed of off-site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Cracked batteries will be stored in a non-leaking secondary container and removed from the site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Spill clean-up materials will be stockpiled where they are readily accessible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Incoming vehicles and equipment will be checked for leaking oil and fluids (including delivery trucks and employee and subcontractor vehicles). Leaking vehicles or equipment will not be allowed on-site.</td>
</tr>
<tr>
<td>BMP - 5</td>
<td>Equipment, Vessel and Vehicle Cleaning</td>
<td>1. Vessel, vehicle, and equipment will be cleaned of any sediment or vegetation before transferring and using in a different watershed, to avoid spreading pathogens or exotic/invasive species between watersheds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Vessels, vehicles, and equipment will not be washed on-site. Vessel, vehicle, and equipment washing will occur at an appropriate wash station.</td>
</tr>
<tr>
<td>BMP - 6</td>
<td>Refueling</td>
<td>1. All fueling sites shall be equipped with secondary containment and avoid a direct connection to underlying soil, surface water, or the storm drainage system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. For stationary equipment that must be fueled on-site, secondary containment such as a drain pan or drop cloth shall be provided in such a manner to prevent accidental spill of fuels to underlying soil, surface water, or the storm drainage system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Fuel for barge-mounted equipment and push boats shall be kept in a double containment system with a spill prevention kit present at all times. All fuel nozzles shall have a shut off valve and sufficient personnel on site to facilitate the refueling. No refueling shall be allowed during inclement weather.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Where necessary, containment boom will be placed around barges at the sill construction site to prevent fuel spills from dispersing into Parsons Slough or Elkhorn Slough.</td>
</tr>
<tr>
<td>BMP - 7</td>
<td>On-Site Hazardous Materials Management</td>
<td>1. The products used and/or expected to be used and the end products that are produced and/or expected to be produced after their use will be inventoried.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. As appropriate, containers will be properly labeled with a “Hazardous Waste” label and hazardous waste will be properly recycled or disposed of off-site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Contact of chemicals with precipitation will be minimized by storing chemicals in watertight containers or in a storage shed (completely enclosed), with appropriate secondary containment to prevent any spillage or leakage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Quantities of equipment fuels and lubricants greater than 55 gallons shall be provided with secondary containment that is capable of containing 110 percent of the volume of primary container(s).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Petroleum products, chemicals, cement, fuels, lubricants, and non-storm drainage water or water contaminated with the aforementioned materials shall not be allowed to enter receiving waters or the storm drainage system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Sanitation facilities (e.g., portable toilets) will be surrounded by a berm, and a direct connection to the storm drainage system or receiving water will be avoided.</td>
</tr>
<tr>
<td>BMP ID</td>
<td>Name</td>
<td>BMP</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>7. Sanitation facilities will be regularly cleaned and/or replaced, and inspected regularly for leaks and spills.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Waste disposal containers will be covered when they are not in use, and a direct connection to the storm drainage system or receiving water will be avoided.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. All trash that is brought to a project site during construction activities (e.g., plastic water bottles, plastic lunch bags) will be removed from the site daily.</td>
</tr>
<tr>
<td>BMP - 8</td>
<td>Fire Prevention</td>
<td>1. All earthmoving and portable equipment with internal combustion engines will be equipped with spark arrestors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. During the high fire danger period (April 1–December 1), work crews will have appropriate fire suppression equipment available at the work site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. On days when the fire danger is high, flammable materials will be kept at least 10 feet away from any equipment that could produce a spark, fire, or flame.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. On days when the fire danger is high, portable tools powered by gasoline-fueled internal combustion engines will not be used within 25 feet of any flammable materials unless at least one round-point shovel or fire extinguisher is within immediate reach of the work crew (no more 25 feet away from the work area).</td>
</tr>
<tr>
<td>BMP - 9</td>
<td>Work Site Housekeeping</td>
<td>1. The work site will be maintained in a neat and orderly condition, and left in a neat, clean, and orderly condition when work is complete. Paved access roads will be swept and cleared of any residual vegetation or dirt resulting from the construction activity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Materials or equipment left on the site overnight will be stored as inconspicuously as possible, and will be neatly arranged.</td>
</tr>
</tbody>
</table>
**Marine Mammals**

Southern sea otter and harbor seal are known to inhabit the project area. There are currently 17 to 28 sea otters using the Parsons Slough Complex and adjacent Yampah Island (Maldini et al. 2010). There are an estimated 100 harbor seals using the mudflats to haul out in the Parsons Slough Complex during low tide (Maldini et al. 2010). Construction activities (noise, light, and human disturbance) could have temporary, short-term impacts on individual marine mammals that currently inhabit the Parsons Slough Complex. In February 2010, NOAA, the Federal funding agency for the proposed project, initiated consultation with USFWS and NMFS in accordance with the ESA and MMPA. To date, USFWS and NMFS have identified project specific mitigation measures to reduce project-related impacts to marine mammals. These measures include conducting pre-construction surveys for marine mammals to document abundance and distribution of seals and otters in the project area and conducting post-construction surveys for marine mammals to document marine mammal response to presence of the sill structure (See Mitigation Measure IV-5 below). Implementation of BMPs identified in Table IV-2 in addition to Mitigation Measure IV-2 would reduce the potential construction-related impacts on marine mammals to *less than significant with mitigation*.

**Mitigation Measure IV-2.** Marine mammal monitoring during construction of the sill shall occur by a qualified wildlife biologist from the established observation point adjacent to the UPRR bridge, as well as intermittently from a small motorized boat. Daily construction monitoring shall begin 30 minutes prior to construction activities and continue until construction personnel have left the site. The biological monitor shall maintain a log that documents the number of marine mammals present before, during, and at the end of daily activities. The monitor shall record basic weather conditions (ambient temperature, tidal activity, precipitation, wind, etc.), as well as marine mammal behavior. The biological monitor shall have authority to stop construction before a marine mammal becomes severely harassed (Level A harassment under the MMPA, defined as potential to injure a marine mammal or marine mammal stock in the wild). A report shall be completed and submitted to USFWS within 30 days of the completion of the sill construction and shall include a summary of the daily log maintained by the monitor during construction.

The following additional measures shall be implemented to further reduce construction-related impacts on marine mammals to a less than significant level.

1. **Seasonal timing of construction** shall correspond with the non-pupping season for marine mammals (September 1 – February 28).

2. **Before the onset of construction activities** a qualified biologist will conduct an education program for all construction personnel. At a minimum the training will include a description of southern sea otter and harbor seals and their habitats; the occurrence of these species within the project area; an explanation of the status of these species and protection under the Federal ESA and MMPA; the measures that are being implemented to minimize disturbance to marine mammals and their habitats as they relate to the construction; and the authority given to the biological monitor to stop construction at any point. A fact sheet conveying this information will be prepared for distribution to the construction personnel and other project personnel who may enter the project area. Upon completion of the program, personnel will sign a form stating that they attended the program and understand all the avoidance and minimization measures and implications of the Federal ESA and MMPA.
3. Because marine mammal presence is lowest during high tide events (Maldini et al. 2009), the construction contractor shall be encouraged to conduct most of the noise disturbing construction activities (pile driving) during high tide.

4. To reduce the risk of potentially startling marine mammals with a sudden intensive sound, the construction contractor shall begin construction activities gradually, moving into the area slowly and initiating the most disturbing activities (i.e. pile driving) after most of the marine mammals flush from the area. Biological monitors shall be present at least 30 minutes prior to the initiation of daily construction activities and shall have authority to stop construction if marine mammals appear harassed.

5. Pile driving activities will be designed to assure compliance with NMFS and USFWS criteria for Sound Exposure Levels (SEL) for marine mammals, in compliance with the ESA and MMPA. Until formal guidance is available in the Biological Opinion and Incidental Harassment Authorizations for the proposed project, conservative estimates of distances to marine mammal safety zones have been established. These distances are based on the following thresholds of sound pressure levels from broad band sounds that cause behavioral disturbance (Reyff 2007):

- 90 decibels [dB] re: 1μPa for in air sound pressure levels in harbor seals and 100 dB re: 1μPa for in air disturbance in sea otters;
- 120 dB re: 1μPa for under water continuous or vibratory sound levels for both harbor seals and sea otters; and
- 160 dB re: 1μPa for under water impulsive or impact sound levels for both harbor seals and sea otters.

6. Distances to marine mammal safety zones have been estimated and will be enforced through monitoring sound levels and marine mammals during construction. These distances are approximate and conservative and may change with formal guidance provided in the Biological Opinion and Incidental Harassment Authorizations for the proposed project.

- In air safety zones for harbor seals during vibratory hammering are estimated to be 100-feet for H-piles and 120-feet for sheet piles.
- In air safety zones for harbor seals during impact hammering are estimated to be 600-feet for H-piles and 450-feet for sheet piles.
- In air safety zones for sea otters during vibratory hammering are estimated to be 40-feet for H-piles and 50-feet for sheet piles.
- In air safety zones for sea otters during impact hammering are estimated to be 200-feet for H-piles and 140-feet for sheet piles.
- Under water safety zones during vibratory hammering are estimated to be 3,740-feet for H-piles and 7,400-feet for sheet piles for marine mammals.
- Under water safety zones during impact hammering are estimated to be 745-feet for H-piles and 245-feet for sheet piles for marine mammals.

7. To reduce sound pressure levels to the greatest extent feasible, when impact hammers are used, a cushioning block between hammer and pile shall be used.
8. All fueling and equipment maintenance activities will be conducted in a designated area to prevent inadvertent fluid spills from adversely impacting water quality. To the extent possible, maintenance and fueling activities will be conducted at Kirby Park, or another off-site location, on impervious surfaces at least 50 feet away from surface waters. If maintenance or fueling must occur on-site (i.e., on barges or on land adjacent to the sill construction site), the maintenance/refueling area will be set up to ensure that spills or runoff are not able to discharge to surface waters. For maintenance and fueling activities that must occur on barges, barriers (e.g., sandbags, scupper blocks) will be placed over all overboard discharge locations to prevent the introduction of contaminants to adjacent water bodies. Fuel shall be kept in a double containment system with a spill prevention kit present at all times. All fuel nozzles shall have a shut off valve and sufficient personnel on site to facilitate the refueling. No refueling shall be allowed during inclement weather. Maintenance and fueling activities that occur on land adjacent to the sill construction site shall be located in an area that prevents a direct connection to surface waters. This area will be clearly designated with berms, sandbags, or other barrier.

*Fish*

A detailed discussion of fish species with potential to occur in the Elkhorn Slough Complex is provided in Appendix B. At least 102 fish species have been identified in Elkhorn Slough and adjacent waters, but the majority (82 species) of these are marine fishes from Monterey Bay. As described in Appendix B, recent (2005) surveys conducted in the northern portion of the Parsons Slough complex found topsmelt (*Atherinops affinis*), shiner surfperch (*Cymatogaster aggregata*), longjaw mudsucker (*Gillichthys mirabilis*), Pacific staghorn sculpin (*Leptocottus armatus*), California halibut (*Paralichthys californicus*), thornback (*Platyrhinodis triseriata*), plainfin midshipman (*Porichthys notatus*), northern anchovy (*Engraulis mordax*), bay pipefish (*Syngnathus leptorhynchus*), and fantail sole (*Xystreurys liolepis*) (Moffatt & Nichol 2008).

Three federally-listed salmonid species occur in the waters of Monterey Bay: coho salmon, Chinook salmon, and steelhead. Based on discussions with NMFS staff, it was determined that while all three salmonid species may at times stray into Elkhorn Slough, including the Parsons Slough Complex, their occurrences are deemed sufficiently infrequent that the proposed project would be unlikely to affect these species (Stevens pers. comm. 2010). Similarly, there is very little data on green sturgeon presence in, and use of, Elkhorn Slough. Based on available data and discussions with NMFS staff, it was determined that while green sturgeon may at times stray into Elkhorn Slough, their occurrences are deemed sufficiently infrequent that the proposed project would not impact the species (Stevens pers. comm. 2010). Finally, although tidewater gobies have a high potential to occur in Bennett and Moro Cojo (two slough complexes that are part of the overall Elkhorn Slough Complex), the species’ dependence on low tidal flows is expected to exclude it from the main channel of Elkhorn Slough as well as the Parsons Slough Complex.

In general, it is anticipated that fish will leave the project area and immediate vicinity during construction activities, and that they would not be directly impacted (e.g., crushed, impinged, trapped) by in-water construction activities. There is potential for fish to be impacted by changes in water quality during construction; noise associated with pile driving; habitat modification and loss; and changes in water quality after the sill is in place. These potential impacts are described in more detail below.
Construction-Related Water Quality Impacts

Construction activities could have temporary, short-term impacts (e.g., increased sedimentation and turbidity, releases of oxygen-demanding substances, underwater sound pressures) on fish if present within the Parsons Slough Complex or in the vicinity of the staging area at the time of construction. Implementation of Mitigation Measure IV-1 would require the project applicant to implement BMPs for minimizing stormwater runoff and potential water quality impacts associated with construction activities to less than significant with mitigation.

Noise Impacts

Pile driving activities create underwater sound pressure levels that may adversely affect fish species. Fish may be injured or killed by the impact sounds generated by percussive pile driving. Their hearing may also be affected or their behavior altered such that it constitutes harassment or harm. The specific effects of pile driving on fish depend on a wide range of factors including the type of pile, type of hammer, fish species, environmental setting, and many other factors.

Implementation of Mitigation Measure IV-2 would reduce potential noise related impacts to less than significant with mitigation. The maximum SEL prescribed for marine mammals in Mitigation Measure IV-2 are lower than those recommended by NMFS in their guidance document Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities (NMFS et al. 2008). The most conservative recommendation in that guidance document is for areas where fish smaller than 2 millimeter (mm) in length are present; in those instances, an SEL of 183 dB is recommended, which is higher than the 90 to 160 dB prescribed in Mitigation Measure IV-2. Presence of a biological monitor, as prescribed in Mitigation Measure IV-3 would also reduce potential impacts to fish during pile driving.

Habitat Loss or Modification

Construction of the proposed project would require placement of about 2,000 CY of fill (rock and sheet pile) and result in the permanent loss of approximately 0.75 acres of subtidal habitat within the project footprint. Subtidal habitat is used by some species of fish for foraging and breeding. The expected extent of direct habitat loss is equivalent to approximately 1 percent of the existing subtidal habitat area (74 acres) present within Parsons Slough and a fraction of the subtidal habitat within Elkhorn Slough. Although this alteration would be permanent, the proposed project would not appreciably diminish the availability of subtidal habitat within Elkhorn Slough. Moreover, installation of the proposed sill structure is expected to result in a net gain of subtidal habitat (see below). Thus, the permanent loss of approximately 0.75 acres subtidal habitat is considered a less than significant impact and no mitigation is required.

In addition to direct habitat loss resulting from project construction, installation of the sill structure is expected to result in the conversion of intertidal mudflat habitat to subtidal habitat. Based on modeling of the potential future habitat distribution in Parsons Slough, subtidal habitat acreage may increase by approximately 8 percent from a current total of 74 acres to 80 acres, while intertidal mudflat acreage may decrease by approximately 2 percent from a current total of 346 acres to 338 acres (Table VII-2; Ducks Unlimited et al. 2010a, Gentler pers. comm. 2010). Intertidal mudflats are important feeding grounds for many native fish species. The expected conversion of up to 8 acres of currently dominant intertidal mudflat to currently rare subtidal habitat in Parsons Slough would not constitute a significant habitat loss for fish species due to the relative abundance of intertidal mudflat available for foraging fish in the project area. Thus, this impact is considered less than significant and no mitigation is required.
Water Quality Impacts Associated with Installation of the Sill

As described in detail in Section VIII, *Hydrology and Water Quality*, installation of the sill could potentially impact water quality within a portion of the Parsons Slough inlet channel by stratifying water along the channel bottom immediately upstream of the sill. The sill could focus tidal flows in the channel cross-section to flow above the sill, thereby decreasing circulation of the portion of the water column that is below the sill’s invert elevation within the channel upstream of the sill. The area of the channel bottom that would likely experience decreased hydraulic circulation (and therefore increased stratification) is conservatively estimated to be 1.5 acres in size, which is the area of deep channels in the vicinity of the structure (Largay pers. comm. 2010). Increased stratification in this area could potentially result in the development of low DO conditions. Dissolved oxygen is one of the most critical water quality parameters to the support of biological systems. Lack of adequate DO in the water column can adversely affect a broad range of aquatic species. For example, green sturgeon have been shown to occupy waters with DO concentrations within a 6.54 to 8.98 milligrams per liter (mg/L) range (NMFS 2008). Although Parsons Slough experiences frequent events of severely low DO concentrations under existing conditions, project-related increases in the frequency and/or duration of low DO events, particularly those associated with hypoxic (less than 5mg/L DO) or anoxic (less than 2 mg/L DO) events, could significantly impact aquatic species in the project vicinity. Implementation of Mitigation Measure VIII-1 in Section VIII, *Hydrology and Water Quality*, would reduce this potential impact to *less than significant with mitigation*.

**Birds**

Suitable foraging and roosting habitat for special-status and migratory birds occurs in the project area. Special-status birds with potential to occur in the project area are listed in Table 2 in Appendix B. Upland areas surrounding the project area provide potential nesting habitat for special-status birds, including raptors, and nesting birds protected under the MBTA. Shorebirds forage in intertidal mudflat habitat during low tide, while waterfowl roost and forage in subtidal habitat within Parsons Slough. Although no formal surveys for special-status birds were conducted in support of this project, past surveys suggest that densities of shorebirds in Parsons Slough are low relative to other parts of the Elkhorn Slough estuary (Wasson pers. comm. 2010b). There is evidence that an abundance of suitable foraging habitat is available to waterfowl and shorebirds (benthic invertebrates) throughout the larger Elkhorn Slough (Oliver et al. 2009).

Waterfowl and shorebirds that forage and roost in Elkhorn Slough may be temporarily impacted by construction noise and permanently impacted by the loss of up to 8 acres of mudflat (intertidal) habitat. Temporary disturbance to roosting birds (including California brown pelican, which roost in open water habitat in Parsons Slough) during the 3 to 4 month construction period would not be considered a significant impact because there is an abundance of suitable roosting habitat available to these birds in the larger Elkhorn Slough. Temporarily displaced waterfowl and shorebirds will move to other suitable roosting and foraging habitat during construction.

The permanent loss of intertidal mudflat habitat and slight increase in subtidal habitat could shift the relative abundance of bird species that occupy Parsons Slough. The expected extent of mudflat habitat loss is approximately 2 percent of what is presently available (approximately 346 acres of intertidal habitat would be converted to 338 acres of intertidal habitat). Based on predictions by regional biologists, the abundance of waterfowl is expected to increase due to the conversion of intertidal habitat to subtidal habitat; therefore, project activities would not result in an overall decrease in bird abundance but a shift in species’ distributions (Wasson pers. comm. 2010b). This impact is considered *less than significant* and no mitigation is required.
Potential impacts to nesting birds as a result of project disturbance during construction is considered less than significant because disturbance in the project area would be restricted to 3 to 4 months during the non-breeding season (September through December). This impact is considered **less than significant** and no mitigation is necessary.

**Invertebrates**

The proposed project is aimed at reducing tidal velocities and ranges within the Parson Slough Complex and other parts of Elkhorn Slough. California brackish water snails currently only occur within areas of Elkhorn Slough that exhibit low tidal velocities (Ritter et al. 2008, Oliver et al. 2009). Implementation of the proposed project is not expected to impact California brackish water snails, and may in fact improve habitat conditions within Parsons Slough for this species. This is considered potentially beneficial and represents a **less than significant** impact.

The Olympia oyster restoration component of the project would contribute to a more balanced habitat distribution mosaic and provide overall ecological benefits to the estuarine function of the project area. Within Parsons Slough, ten reefs would be constructed of a mix of large native clams shells secured in a matrix of cement made using local estuarine sediment. Each reef would be about 30 feet long, 2 feet wide, and a half foot tall, made of modular components, and would be placed in northern portions of the Parsons Slough Complex. Based on a smaller pilot project completed in 2008 (Wasson pers. comm. 2010a), it is anticipated that reefs would be placed between 1 and 2 feet above MLLW. Because the area of intertidal disturbance that would result from this action is relatively small (limited to minimal foot traffic in the intertidal mudflat to transport and assemble reef modules), potential construction-related impacts associated with this component of the project are considered minimal. Overall this restoration effort is considered potentially beneficial and represents a **less than significant** impact.

**Special Status Plant Species**

Construction and maintenance of the sill would not directly alter or impact habitat for special-status plants. Changes to the tidal regime in Parsons Slough would provide an opportunity for overall long-term increase in tidal wetland vegetation and a decrease of approximately 8 acres of un-vegetated intertidal mudflat. As such, the proposed project could have a long-term beneficial impact by creating potential habitat for special-status plant species. There would be no direct impact on existing populations of special-status plants.

**Invasive Species**

Non-native invertebrate species currently account for about half the cover on hard substrates and a quarter of the biomass in soft sediments in Elkhorn Slough (Wasson et al. 2001). Placement of rock and sheet pile into the Parsons Slough channel for construction of the sill would provide additional hard substrate for non-native invertebrate species to attach to. Because non-native invertebrate populations are abundant and permanent components of Elkhorn Slough, the additional surface area provided by the sill would not measurably increase abundance of these species in the estuary. As such, the potential for the sill to create new habitat for invasive invertebrate species is considered **less than significant** and no mitigation is required.

Project activities would also include installation of artificial Olympia oyster reefs in the northeastern portion of the Parsons Slough Complex. Information collected during a similar and smaller pilot project in 2008 (Wasson pers. comm. 2010a) found that non-native invertebrate species dominate hard substrates at tidal elevations below MLLW. At tidal elevations between MLLW and +1 foot, non-native invertebrate species are common, but
above +1 foot, they no longer dominate (Wasson pers. comm. 2010b). To minimize the potential that the new reefs would be used by non-native species, the reefs would be deployed at elevations between +1 and +2 feet above MLLW. As such, the potential for the oyster reefs to create new habitat for invasive invertebrate species is considered less than significant and no mitigation is required.

Only four non-native fish species, including striped bass (*Morone saxatilis*), have been reported in Elkhorn Slough (Yoklavich et al. 2002). These non-native species have become widely established throughout California and are unlikely to be eradicated. Structures placed in a channel, such as the proposed sill structure, may provide holding habitat for non-native predatory fish that prey on native fish and other aquatic organisms migrating past the structure; however, juvenile fish tend to be more susceptible to predation than adults and subadults. Given that special-status fish have not been documented in Parsons Slough, no juveniles are expected to occur within the project area and the potential impact of increased predator holding habitat on special-status fish would therefore be negligible. Moreover, installation of the proposed sill is not likely to appreciably increase or decrease the abundance or distribution of non-native fish species within the project area or the Elkhorn Slough Complex. This impact is considered less than significant and no mitigation is necessary.

Finally, all barges would be cleaned before they are placed in-water, minimizing the potential for new invasive species to be introduced to Elkhorn Slough during construction of the sill.

**b) The project’s potential effects on sensitive natural communities are described by community type below.**

**Intertidal Mudflat and Subtidal Habitat**

Staging at Kirby Park would require installation of two temporary floating docks to facilitate barge access, and an additional floating dock and temporary gravel boat ramp to replace public access temporarily displaced during construction. These construction activities would occur in intertidal mudflat and subtidal habitats, both of which are considered special aquatic sites (a subcategory of waters of the U.S., as defined under the CWA), making them sensitive natural communities. Because of the relatively small area of the disturbance, and the fact that disturbed intertidal mudflat / subtidal habitat areas would be restored to preconstruction conditions after construction is complete, temporary impacts to these habitats during construction staging are considered less than significant. No mitigation would be required.

Construction of the sill structure would require placement of about 2,000 CY of fill (rock and sheet pile) and result in the permanent loss of up to 0.75 acres of subtidal habitat within the project footprint. The significance of this impact depends on the relative area of disturbance compared to the overall habitat and community, either locally or regionally. The expected extent of direct habitat loss is equivalent to approximately 1 percent of the subtidal habitat area (72 acres) present within Parsons Slough and a small proportion of the existing subtidal habitat within Elkhorn Slough. Although this alteration would be permanent, it would not appreciably diminish the overall function or habitat value of the area. This impact is considered less than significant and no mitigation is required.

Changes in the tidal prism resulting from implementation of the proposed project are expected to result in the conversion of intertidal mudflat habitat to subtidal habitat. Modeling results predict that subtidal habitat acreage may increase by approximately 8 percent from a current total of 74 acres to 80 acres, while intertidal mudflat acreage may decrease by approximately 2 percent from a current total of 346 acres to 338 acres (Ducks Unlimited et al. 2010a, Gentzler pers. comm. 2010). Given that intertidal mudflat currently dominates the project area, the conversion of up to 8 acres to relatively rare subtidal habitat is a modest step toward a more
balanced estuarine habitat mosaic. In addition, there would be no net loss of a waters of the U.S. or State. This impact is considered **less than significant** and no mitigation is required.

**Salt Marsh Habitat**

About 0.10 acre of salt marsh habitat may be temporarily disturbed during construction of the sill due to its location within the 20-foot disturbance buffer around the proposed sill footprint. An additional 0.05 acre of salt marsh habitat would be filled during construction of the earthen berm associated with the proposed sill and the relocation of the existing drainage adjacent to the west side of the UPRR tracks. These impacts would not appreciably diminish the overall function or habitat value of the area.

The Parsons Slough Complex once supported an abundance of Northern Coastal Salt Marsh, Coastal Brackish Marsh, and Coastal and Valley Freshwater Marsh; however, since the 1980s, much of the vegetated salt marsh cover has been converted to intertidal mudflat as a result of subsidence induced by human alteration when the levee around the site was breached by CDFG in 1982. Changes in the tidal prism resulting from implementation of the proposed project are expected to increase salt marsh acreage within Parsons Slough by one acre (5 percent) over existing conditions. The abundance and/or distribution of brackish and freshwater marsh habitat along the fringes of Parson Slough are not expected to be affected by the project. Although the expected increase in salt marsh habitat is modest, the primary goal of the sill project is to arrest the ongoing trend of gradual salt marsh habitat loss. This is considered potentially beneficial and represents a **less than significant** impact.

**Upland Natural Communities**

Upland natural communities adjacent to the Kirby Park staging area include sensitive communities such as riparian scrub, and non-sensitive communities such as blackberry scrub. These natural communities would be avoided during construction activities. There would be **no impact** on upland natural communities.

c) Construction activities associated with the sill installation, including staging activities at Kirby Park, could result in the disturbance or temporary loss of aquatic communities considered waters of the U.S. or waters of the State. Temporary impacts to salt marsh habitat, intertidal mudflat, and subtidal habitat at Kirby Park and adjacent to the sill site are considered **less than significant** because of the relatively small area of the disturbance, and the fact that disturbed areas would naturally revegetate after construction is complete. Permanent fill of 0.05 acre of salt marsh habitat during construction of the earthen berm and the relocation of the existing drainage adjacent to the UPRR tracks would also be considered **less than significant** because the small proportion of area lost would not appreciably diminish the overall function or habitat value of the area. Finally, conversion of intertidal mudflat to subtidal habitat is considered **less than significant** due to the dominance of intertidal mudflat in the project area, the fact that the conversion would not diminish the overall habitat value, and because the proposed project would not result in a net loss of waters of the U.S. or State.

d) The presence of the submerged sill within the Parsons Slough Channel could present an impediment to the movement of aquatic wildlife into and out of the Parsons Slough Complex. The structure has been designed to minimize interference with the movement of marine mammals and special-status fish into and out of Parsons Slough. As shown in Figures 3a and 3b, the central 100 feet of the sill would be submerged more than 99 percent of the time. This area would include a notch approximately 25 feet wide, with the top elevation of the sheet pile in this notch at an elevation of -5 feet NAVD88. The notch would provide for the passage of water at all tide levels and would facilitate the movement of fish and wildlife into and out of Parsons Slough. The top
elevation of the sheet pile in the remaining 75 feet of the central section of the base structure would be -2 feet NAVD88. In addition, the sill design includes a rockfill buttress on both sides of the sheet pile wall extending from the top of the structure to the channel invert with a slope of 2:1. The rockfill buttress would guide benthic fish and marine mammals moving over the sill through this notch and back down to the channel invert. The buttress would also function to minimize plunging flows across the central bay that could trap aquatic species at the base of the sheet pile as tidal water flows over the sill. Hydraulic modeling conducted for the proposed sill indicates that peak tidal velocities across the structure would range from 7 to 10 feet per second, depending on tidal direction (i.e., flood or ebb). Responses to this barrier and associated changes in tidal velocities are summarized by species type below. Impacts to species movement over the sill described below would be expected to be reduced over time if sea levels eventually rise above the sill structure.

**Marine Mammals**

Marine mammals are capable of navigating flows greater than 10 feet per second (the maximum velocity anticipated over the sill), and changes in velocities that would result from sill placement would not pose a significant risk of injury to sea otters or harbor seals, and would not unduly restrict their movement (Harvey pers. comm. 2010). Due to the documented importance of the Parsons Slough Complex to southern sea otters and harbor seals, unforeseen movement restrictions, harm, or injury to marine mammals would be considered a potentially significant impact. Implementation of Mitigation Measure IV-4 would reduce this potential impact to **less than significant with mitigation**.

**Mitigation Measure IV-3.** Post-construction monitoring of marine mammals shall consist of surveys during peak occupational time and tidal cycle for marine mammals for at least four weeks following construction of the sill; the sill is scheduled for completion by end of January, and the otter pupping season peaks in March and April. Four weeks of monitoring would be conducted by a qualified biologist to determine whether adults and pups are able to move freely across the structure, without evidence of harm or injury. If marine mammals appear to have resumed normal behavior as demonstrated by successfully passing over the sill, then post-construction monitoring would cease. USFWS would be consulted before the cessation of post-construction monitoring.

In the event that post-construction monitoring indicates that adult or juvenile marine mammals are unable to cross the sill, ESNERR would follow a phased approach to increase marine mammal passage over the sill, dependent upon monitoring results. The first phase would be to extend the post-construction monitoring effort to determine whether marine mammals gradually learn to pass through the sill. If monitoring indicates that pups are separated from adults while crossing the sill, and if noticeable stress to individuals that could result in injury occurs, then physical sill modifications, as described below, would be implemented. Sill modifications would first entail altering the configuration of the rockfill buttress to better allow passage of marine mammals (i.e., decreasing the slope). If subsequent monitoring following that alteration show that marine mammals are still unable to cross the sill, then the sill would be lowered to allow easier passage over the structure. The amount by which to lower the sill would be determined through consultation with USFWS and CDFG, and in coordination with any potentially necessary sill lowering actions to mitigate for water quality impacts, following the same methods as described in Mitigation Measure VIII-1.

e) Because the proposed project would not result in the loss of any mature trees and would result in the restoration of tidal marsh habitat, it would be consistent with local policies. The proposed project would have **no impact** on local policies or ordinances protecting biological resources.
f) There are no Habitat Conservation Plans or Natural Community Conservation Plans that apply to the project area or vicinity. Elkhorn Slough is part of and managed in accordance with several other management plans and programs, including the following:

1. Monterey Bay National Marine Sanctuary Final Management Plan (NOAA 2008);
3. Draft Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (USFWS 2010b);
4. Elkhorn Slough Watershed Conservation Plan (Scharffenberger et al. 1999);
5. Salinas Valley Integrated Regional Water Management Plan (RMC 2006); and

Implementation of the proposed project would be consistent with the conservation goals set forth under these plans.

The proposed project area is also located within areas identified as Essential Fish Habitat (EFH) for various life stages of marine and estuarine fish species managed under the following three Fisheries Management Plans (FMPs): Pacific Coast Salmon FMP, Coastal Pelagic Species FMP, and Pacific Coast Groundfish FMP. In addition, the project area is located within an area designated as Habitat Areas of Particular Concern (HAPC) for Pacific Coast groundfish species. Elkhorn Slough is an estuary and is therefore considered an HAPC, and patches of eelgrass occurring within the main channel of Elkhorn Slough constitute seagrass HAPC.

The potential impacts of the proposed project on EFH are similar to the habitat effects discussed under items (a) through (d) above. Potentially significant impacts include temporary habitat disturbances during the construction phase of the project and the potential degradation of water quality. These effects are considered a potentially significant impact on EFH. NOAA has initiated consultation with NMFS under the provisions of the Magnuson-Stevens Act. All recommendations for the proposed project identified by NMFS during the consultation process will be implemented. In addition, implementation of Mitigation Measure IV-1 and Mitigation Measure VIII-1 in Section VIII Water Quality would reduce impacts to EFH to less than significant with mitigation.
## V. CULTURAL RESOURCES

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Cause a substantial adverse change in the significance of a historical resource as defined in '15064.5.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to '15064.5.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>d) Disturb any human remains, including those interred outside of formal cemeteries.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Background:**

Prehistoric and historic resources of the project area were assessed in a cultural resources evaluation prepared by Holman & Associates in January 2010 (Holman & Associates 2010). Except where noted, the Holman and Associates study forms the basis for this chapter. This cultural resources investigation was designed to satisfy environmental requirements specified in CEQA and its guidelines (Title 14 California Code of Resources, Section 15064.5) and Section 106 of the NHPA by: (1) identifying and recording significant cultural resources within an “area of potential effect” (APE), (2) offering a preliminary significance evaluation of the identified cultural resources in accordance with a Phase I investigation, (3) assessing the potential impacts to cultural resources resulting from the implementation of the proposed project, and (4) offering recommendations designed to protect resource integrity, as warranted.

**Literature Review**

An archaeological literature review at the Northwest Information Center (NWIC) was conducted by Holman & Associates to obtain information about recorded historic and/or prehistoric sites in and around the APE, and previous archaeological surveys that had been conducted in the general vicinity of Elkhorn Slough and Parsons Slough. There are no recorded historic and/or prehistoric sites recorded inside the APE, but there are several recorded prehistoric sites in the immediate vicinity, as described below. There have been a total of three surveys that included or were immediately adjacent to the project APE. In 2001, David Chavez and Jan Hupman completed an archaeological field study of the proposed UPRR bridge replacement project, the area adjacent to the proposed sill location, with negative findings. In 1992, Rob Edwards and Charr Smith completed a survey for sites of historical interest in a small parcel of land located just east of the proposed oyster restoration areas with negative findings. The most relevant study was done by John Michael King in 1981 for the 980 acre Elkhorn Slough Estuarine Sanctuary (the former name of ESNERR), a parcel that included all of the current APE (King 1981). Mr. King had been retained to provide the CDFG with an inventory of both historic and prehistoric sites inside the recently consolidated ESNERR lands, with the intent of developing recommendations for the preservation of those resources.
Mr. King and associates completed a comprehensive visual inspection of the entire 980 acre preserve, recording a number of historic sites and a total of 12 previously unrecorded prehistoric sites. The 1981 report contains a summary of archaeological research for Elkhorn Slough and Monterey County in general, utilizing environmental reconstructive data to discuss the 7,000 year record of Native American use of the slough setting.

Despite the record of very old archaeological materials in and around the Moss Landing/Elkhorn Slough area, Mr. King was restricted to identifying and recording only the most recent prehistoric archaeological sites. These can be found on dry land either directly adjacent to the historic water line or close by on marine terraces. King found that three major classes or types of archaeological sites could be identified in the Elkhorn Slough area, based on their surficial characteristics: (1) large occupation sites situated on ancient sand dunes; (2) moderate to large occupation sites on marine terraces; and, (3) special use sites or “camps” adjacent to the historic water line. The latter two types were found to be represented within ESNERR, but the first described was not (King 1981).

While the King study was aimed primarily at providing an inventory of archaeological sites, making conservation recommendations, and providing indications of the research potential of the resources, his report does contain material relevant to this CEQA document. His assessment of the relative importance of the three types of resources were based primarily on the existing archaeological record of the few excavations done at nearby sites. He argued that the combination of different resources in the general area merited the designation of an archaeological district, and that even the apparently simple waterside special use sites he discovered held potentially important information for the understanding of the past several thousand years of use of the estuary by the Native American population.

A more comprehensive survey of the archaeology and prehistory of Elkhorn Slough was prepared by Terry Jones in 2002 (Jones 2002). This survey includes a discussion of the regional archaeological context, and utilizes information gained from the large number of studies that have been done up to the present in Elkhorn Slough, including references about the paleoenvironment as reconstructed through fish studies, palynological studies, and bioarchaeological studies. The Jones overview identifies the scientific importance of even the most simple of the archaeological resources found inside ESNERR – the single use resource procurement areas described as small shell mounds right at the water’s edge. This review also details the Holocene environmental changes at Elkhorn Slough up to the present, discussing the types of sites that have been found and those that haven’t to date – namely resource locations that are currently buried under either water or soil deposits along the current edges of both Elkhorn Slough and Parsons Slough.

**Field Inspection and Native American Consultation**

A visual inspection of the project area was conducted by Holman and Associates in December 2009. On December 22, 2009, Mr. Holman sent a letter to the Native American Heritage Commission (NAHC), asking for a check of the Sacred Lands Files for the project APE. As of late February 2010, two Native American groups (Amah Mutsun Tribal Band and the Ohlone/Costanoan Esselen Nation) have responded that the project area was considered archaeologically sensitive and requested that a tribal monitor be retained to observe any earthmoving activities and to consult with the project proponents regarding the discovery and/or disposition of any cultural resource items or human remains.
Comments:

a, b, d) It is not possible to conduct visual archaeological inspections of the sill site and proposed oyster restoration areas because both areas are located primarily underwater. Holman & Associates (2010) concluded that there remains a slight chance that buried archaeological resources in the vicinity of the proposed sill site and oyster restoration areas could be uncovered if mechanical excavation is required for their installation. With the implementation of Mitigation Measure V-1, the potential impacts associated with disturbing buried archaeological deposits would be *less than significant with mitigation*.

**Mitigation Measure V-1:** An archaeological monitor shall be retained to observe any mechanical excavation at the proposed sill site or oyster restoration areas, if mechanical excavation is needed. The monitor would be responsible for identifying and retrieving any prehistoric archaeological materials uncovered for analysis, as appropriate.

c) The proposed project would not affect paleontological resources because it would not excavate or otherwise affect materials below recent sediments. Therefore it would have *no impact* on paleontological resources.
VI. GEOLOGY AND SOILS

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii) Strong seismic ground shaking.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii) Seismic-related ground failure, including liquefaction.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv) Landslides.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Result in substantial soil erosion or the loss of topsoil.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

a) The Monterey Bay region overlies a large mass of Cretaceous granitic rocks termed the Salinian Block. Since the early Miocene, the Salinian Block has been carried northward on the Pacific Plate along the active transform plate boundary between the Pacific and North American tectonic plates. The relative motion between the two plates is described as right-lateral strike-slip. This motion is accommodated by the seismically active San Andreas Fault System.

The closest faults to the project area are the Zayante-Vergeles Fault (9.2 kilometers [km] distant), the Rincondada Fault (15 km distant), and the San Andreas Fault (15 km distant). The project area is not located within an Alquist-Priolo Earthquake Fault Zone and there is no known evidence of active or potentially active faults crossing under the project area (URS et al. 2010).
According to the 1998 California Building Code, the project area is located in Seismic Zone 4 and the soil type is SE, a soil profile with more than 10 feet of soft clay and an undrained shear strength of less than 500 pounds per square foot (URS et al. 2010). Kleinfelder (2002) provides a probabilistic seismic hazard analysis for the UPRR bridge site to develop the design basis earthquake (DBE), which is defined in the 1997 Uniform Building Code as the ground motion with a 10 percent probably of exceedance in 50 years (475 year return period). The DBE peak horizontal acceleration for the UPRR bridge site was determined to be 0.55g. As such, the design earthquake for the sill structure, which is not a critical structure, was selected as a DBE of 0.55g (URS et al. 2010).

The California Division of Mines and Geology has listed the San Gregorio Fault as having the potential for a significant magnitude earthquake (moment magnitude \[M_w\] of 6.0 or greater). USGS estimates a 21 percent probability of an earthquake with an \[M_w\] of 6.7 or greater occurring in San Andreas Fault before 2032 (The Working Group on Northern California Earthquake Potential 2003).

The proposed project would not expose people or structures to potential substantial adverse effects due to seismic groundshaking, liquefaction, or landslides because this sill would be designed to withstand groundshaking and seismic ground failure hazards, including liquefaction. Furthermore, the nearly flat sill site is not subject to landsliding or other slope failure hazards. There would be no impact to this environmental factor.

b) Construction activities at the staging area could potentially result in the disturbance and erosion of sediment from the staging area into the slough. Mitigation Measure IV-1, described in Section IV, Biological Resources, would minimize potential effects associated with the possible release of sediment from upland areas during construction. In addition, to minimize additional erosion of pavement from the Kirby Parking lot into the adjacent intertidal mudflat habitat, rock would be placed along the edge of the parking lot (within previously paved areas or areas covered by remaining, intact gravel roadbase, and above 4.8 feet elevation [i.e., MHW]) to stabilize exposed soils after construction is complete. Construction activities associated with sill installation would cause minor disturbance of submerged soils; however, because these activities would occur only during slack tides, movement of sediment from disturbed areas would be minimal. This potential impact is considered less than significant with mitigation.

The proposed project is intended to reduce erosion from Parsons Slough and Elkhorn Sloughs by decreasing tidal velocities and tidal prisms at the mouth of Parsons Slough. Parsons Slough contains the largest area of subsided former marshlands within Elkhorn Slough (Elkhorn Slough Tidal Wetland Project Team 2007). Most of Parsons Slough lies between 0 and +3 feet NAVD88, with the lowest areas concentrated in the eastern portion of the slough. The channels of Elkhorn Slough, including Parsons Slough, are deepening and widening due to various factors including head-cutting within the main tidal channel, erosion from an increasing tidal prism, residual effects of past diking/draining/farming activities within the former marsh, and reduced sediment input from the Salinas River. This erosional process is removing soft subtidal sediment from the slough and changing the types of habitats it supports. This trend is projected to continue over the long term and is not expected to diminish or decline in the near future without human intervention. Project activities are intended to reduce erosion over the long-term in the larger Elkhorn Slough. For a discussion of the effects of tidal scour and potential impacts of the proposed project on geomorphology, please refer to Section VII, Hydrology and Water Quality, and Appendix C.

---

2 “g” is a common value of acceleration equal to 9.8 meters per second per second, or the acceleration due to gravity at the surface of the earth.
c) The geotechnical conditions in the vicinity of the sill structure are based on two borings drilled in September 2001 for the replacement of UPRR Bridge MP 103.27 Coast Subdivision (Kleinfelder, Inc. 2002). The two borings, which were located approximately 40 feet downstream of the bridge, were drilled to depths of 89 and 99 feet below the channel invert. The subsurface conditions found in both borings were approximately 62 feet of soft clayey silt underlain by very dense sandy soils. The proposed project would not impact or change the value of any geological resources. **No impact** would occur.

d) The project would not be subject to expansive soil conditions because the soils at the sill site are silts and sands and are continuously wetted. Therefore they would not have any opportunity to shrink and swell. **No impact** would occur.

e) No septic systems are proposed as part of the project. **No impact** would occur.
VII. HAZARDS AND HAZARDOUS MATERIALS

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>b) 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.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within a quarter mile of an existing or proposed school.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 (“Cortese List,” prepared by the California Integrated Waste Management Board) and, as a result, would it create a significant hazard to the public or the environment.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) For a project 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, would the project result in a safety hazard for people residing or working in the project area.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

a – c) Small quantities of paints, solvents, and other hazardous materials would be used during construction. These would be stored and handled appropriately, and would not result in a public hazard. Construction equipment would not be re-fueled or repaired in the project area. Oil and other hazardous materials are occasionally transported by train along the UPRR railroad tracks that bisect the project area; however, the proposed project would not affect railroad operation or safety. The project area is not with 0.25 mile of a school. Occupational Safety and Health Administration (OSHA) regulations require that a project-specific health and safety plan be developed prior to any construction activities by the construction contractor. The site- and project-specific health and safety plan would identify potential safety hazards in the construction area (e.g.,
operation of heavy equipment on a barge) and would identify standard safety precautions to ensure worker health (use of lifejackets, hearing protection). The health and safety plan would also identify whom to contact in an emergency and the location of the nearest medical facility. Measures identified in the health and safety plan would be implemented to protect workers at the site. Impacts would be less than significant.

d) The project area is not listed on the “Cortese List” of hazardous materials sites (http://www.envirostor.dtsc.ca.gov). No impact would occur.

e) The project area is not located within 2 miles of a public airport or under a current airport land use plan. The closest airport is located in Watsonville, approximately 10 miles north of the project area. No impact would occur.

f) A private airstrip is located near Long Valley Spur, approximately 1.75 miles east of the project area. The proposed project would not result in a safety hazard for people residing or working in the project area because it would not involve any obstructions to aircraft flight paths. No impact would occur.

g – h) The project area is not located on a busy thoroughfare and would not increase traffic; therefore, it would not interfere with an emergency response or evacuation plan. Access between the sill site and Kirby Park staging area would be by barge through the Elkhorn Slough main channel, which is not part of an emergency evacuation route. The project would be located in a National Estuarine Reserve and would be mostly submerged in a slough; therefore, it would not expose people or structures to risk involving wildland fires. No impact would occur.
## VIII. HYDROLOGY AND WATER QUALITY

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Violate any water quality standards or waste discharge requirements.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>e) 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.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Otherwise substantially degrade water quality.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>i) 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.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>j) Inundation by seiche, tsunami, or mudflow.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

### Background:

Detailed information describing existing and historic hydrologic and water quality conditions within Parsons Slough is provided in Appendix C. The following provides a summary of the primary parameters of interest to this analysis presented in this Initial Study.

#### Tidal Hydrology

Parsons Slough is a tidal estuary within the greater Elkhorn Slough estuary along the central shoreline of Monterey Bay. Historic recording of water surface elevations within Parsons Slough has indicated that the slough has a tidal signature that is almost identical to that of the Monterey reference station (VanDyke pers. comm. 2009, Broenkow and Breaker 2005), though there is a slight (less than one hour) lag time between tides at the two locations. Tidal datums are shown in Table VII-1 below.
The tidal prism of Parsons Slough has been calculated using a variety of methods, as summarized in Appendix C. For this analysis the tidal prism of Parsons Slough is considered to be 1,087 acre-feet (Table VII-2). While estimates of the total tidal prism within Elkhorn Slough vary, the tidal prism of the Parsons system is described in most of the literature as providing approximately one-third of the tidal prism of the entire Elkhorn Slough Complex (Philip Williams and Associates et al. 2008). The slough’s hydraulic residence time (the number of tidal cycles it takes tides within Parsons Slough to completely flush the tidal prism from the system and replace it with entirely new tidal waters) has been calculated to be 1.5 tidal cycles (Moffatt & Nichol 2009).

Parsons Slough is consistently ebb-dominated, meaning that tidal flows on an ebb (receding) tide are faster and stronger than flows on a flood tide (and therefore capable of mobilizing relatively more sediment). Hydraulic and geomorphic modeling indicate that it is the extreme tides, and in particular the peak spring ebb tide, that move sediment within Elkhorn Slough (Philip Williams and Associates 2010). As a result, as peak spring ebb flow discharges from Parsons Slough are reduced, so is tidal scour in Elkhorn Slough as a whole (Philip Williams and Associates 2010). Maximum tidal flow velocities at the UPRR bridge have been measured well above the range sufficient to mobilize sediments from mudflats and channels within the slough complex (Broenkow and Breaker 2005, Sea Engineering 2006). Tidal flow velocities are partially dependent on the magnitude of the tidal prism; the smaller the tidal prism that moves through a given cross-section, the lower the flow velocities will be.

Table VIII-1 Tidal Datums within Monterey Bay

<table>
<thead>
<tr>
<th>Tidal Datum</th>
<th>Elevations at Monterey (941-3450), ft NAVD88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Higher High Water (MHHW)</td>
<td>5.48</td>
</tr>
<tr>
<td>Mean High Water (MHW)</td>
<td>4.77</td>
</tr>
<tr>
<td>Mean Sea Level (MSL)</td>
<td>3.01</td>
</tr>
<tr>
<td>Mean Tide Level (MTL)</td>
<td>2.97</td>
</tr>
<tr>
<td>Mean Low Water (MLW)</td>
<td>1.23</td>
</tr>
<tr>
<td>Mean Lower Low Water (MLLW)</td>
<td>0.14</td>
</tr>
<tr>
<td>Tidal range (ft)</td>
<td>5.33</td>
</tr>
</tbody>
</table>

Source: NOAA 2010
Table VIII-2 Tidal Prisms, Flood Volumes, and Habitat Extent With and Without the Proposed Sill\(^1\)

<table>
<thead>
<tr>
<th>Modeled Scenario</th>
<th>Average flood and ebb tidal prism(^2) (acre-feet)</th>
<th>Spring Tide(^3) Flood Volumes (acre-feet)</th>
<th>Spring Tide(^3) Ebb Volumes (acre-feet)</th>
<th>Tidal Range(^4) (feet)</th>
<th>Salt Marsh(^5) (acres)</th>
<th>Intertidal Mudflat(^6) (acres)</th>
<th>Subtidal(^7) (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>1,087</td>
<td>1,636</td>
<td>2,242</td>
<td>5.61</td>
<td>20</td>
<td>346</td>
<td>74</td>
</tr>
<tr>
<td>Proposed Sill(^8)</td>
<td>1,082</td>
<td>1,620</td>
<td>2,218</td>
<td>5.36</td>
<td>21</td>
<td>338</td>
<td>80</td>
</tr>
<tr>
<td>Percent Change</td>
<td>(&lt;1)</td>
<td>(&lt;1)</td>
<td>(1)</td>
<td>(4)</td>
<td>5</td>
<td>(2)</td>
<td>8</td>
</tr>
</tbody>
</table>

Source: Ducks Unlimited et al. 2010a; Gentzler pers. comm. 2010

1 Calculated during the 28-day Period between 12/9/2005 and 1/6/2006
2 Calculated as the average of the flood and ebb volumes during the 28-day period. Volumes less than 100-acre feet calculated during brief changes in direction near slack tide were excluded from the average.
3 Spring tide flood and ebb volumes were calculated as the average of the highest three flood or ebb volumes within the first half and second half of the 28-day period.
4 Tidal range was calculated as the difference between Mean Higher High Water and Mean Lower Low Water.
5 Assumed that entire area above Mean High Water within the 440-acre area of Parsons Slough is considered salt marsh.
6 Assumed that intertidal mudflat is the area between Mean Lower Low Water and Mean High Water.
7 Assumed that subtidal area is below Mean Lower Low Water.
8 Proposed sill calculations based on URS analysis of most open setting of previously adjustable sill (8 gates, 28-feet wide opening)
Watershed Hydrology

Parsons Slough has a relatively small watershed that includes the ephemeral drainages of Paradise Valley, Long Valley, and other adjacent canyons. Land uses in the watershed are primarily undeveloped grasslands, pastures for cattle grazing, cultivated row crops, and low- to medium-density rural development. Runoff from the watershed contributes a number of pollutants to the slough, including nutrients (primarily nitrogen and phosphorus) and pathogens, but it also contributes sediment to a sediment-starved system. Precipitation that falls within the Parsons Slough watershed drains from the uplands through ephemeral drainages into slough habitats, and eventually flows to Elkhorn Slough and Monterey Bay by tidal action.

Relatively little is known about shallow groundwater within the Elkhorn basin. It has been suggested that groundwater contributions to slough hydrology have decreased as agricultural pumping operations in the basin have increased. The main evidence for this claim is the lack of artesian wells and seeps that were once common in the area (Caffrey and Broenkow 2002, Moffatt & Nichol 2008). These claims are bolstered by increases in chloride concentrations in wells near Elkhorn Slough, as saline influence from the slough has progressed farther inland, potentially in response to increased groundwater pumping (Monterey County Water Resources Agency 2005).

Water Quality

The primary water quality variable of interest within Parsons Slough is DO, which is one of the most critical water quality parameters to the support of biological systems. Lack of adequate DO in the water column can adversely affect a broad range of aquatic and benthic wildlife on multiple trophic levels, including fish, sharks, rays, clams, oysters, crabs, and worms. Most surface waters in Central California have average DO concentration of 8-12 mg/L (CCAMP 2010); 98 percent of coastal waters in California typically have DO levels above 5 mg/L (SWRCB 2006). Dissolved oxygen levels below 5 mg/L are typically deemed “hypoxic” (low oxygen) for aerobic organisms (fish, amphibians, etc.), while levels below 2 mg/L are considered “functionally anoxic” (most aquatic organisms would respond as if there were no oxygen).

Daily and Seasonal DO Variations

Extreme increases in DO (up to DO supersaturation, or DO levels above 100 percent saturation) are induced by primary production in the water column or along the benthos – e.g., the oxygen produced by algae, phytoplankton, and other submerged aquatic plants (such as eelgrass) during the day through photosynthesis. Water quality monitoring data from Parsons Slough contains frequent instances of DO supersaturation; these events do not seem to be limited to a particular seasonal set of conditions (Appendix C). It is possible that many of these supersaturation events are tied to low-turbidity events, as photosynthesis is a light-dependent process. In times of algal blooms (sudden population increases driven by seasonal cycles), DO can increase to supersaturated levels during the day, and then rapidly crash to hypoxic or even anoxic levels once the sun sets and primary producers and microbes in the water column and benthos turn to respiration, which consumes DO in the water column. This diurnal signal has been observed in historic data from Parsons Slough, though it should be noted that the DO swings observed at Parsons are far less extreme than those observed at poorly flushed sites such as Azevedo Pond, a diked wetland farther up the main Elkhorn Slough channel (Caffrey 2002). Tidal flows also can influence DO concentrations on a semi-diurnal cycle by transporting high-DO water from Monterey Bay into the slough on a flood tide, and removing lower-DO water from the slough into Elkhorn Slough and eventually the Bay on an ebb tide.
In Parsons Slough, severe low DO events are frequent during the summer and early fall, when nighttime DO crashes become cumulatively worse as the system accumulates both respiring algae and decomposing organic material (see Eutrophication Effects below) due to summertime productivity. Sudden decreases in DO can also occur when there is water column turbulence, which can re-suspend organic material with high biological oxygen demand (BOD) from the benthos and cause a corresponding decrease in DO.

**Eutrophication Effects**

Dissolved oxygen levels in estuaries such as Parsons Slough are also strongly influenced by the development of eutrophic conditions. Eutrophication is generally defined as the enrichment of a water body with nutrients or organic material. These constituents induce rapid growth of phytoplankton and other primary producers that cannot be sustained. When the primary producers die, their decomposition consumes significant quantities of DO within the water column. While this phenomenon is not uncommon in estuaries, which tend to act as “sinks” for nutrients within watersheds, it can be exacerbated by land use practices such as irrigated/fertilized agriculture, grazing, and other practices that result in large inputs of nutrients. Water quality data collected by ESNERR indicate that eutrophication in Elkhorn Slough is a concern, especially in tidally restricted areas such as Azevedo Pond. In its recent updates to the CWA 303(d) list of impaired water bodies, the Central Coast RWQCB recommended listing Elkhorn Slough (including Parsons Slough) as impaired for DO, a decision supported by ESNERR scientists (ESNERR 2009).

Currently, extensive beds of sea lettuce (Ulva spp., also known by the outdated taxon Enteromorpha) are present floating and on mudflats throughout the slough. These algae beds constitute a major source of highly labile organic material (material subject to aerobic decomposition) within Parsons Slough. When algae and other organic material decompose in the slough, flushing action within the slough system prevents the development of severely hypoxic and anoxic waters, with the exception of the tidally restricted areas described above. In these areas of poor tidal circulation, resultant increases in hydraulic residence times exacerbate eutrophication and attendant low DO levels by prolonging the period of time that water is in contact with high-BOD bottom sediments. This lowers DO levels in the water column at these locations even further. Under periods of exceptionally poor circulation, bottom waters can become anoxic, potentially inducing the release of nutrients such as ammonium ($\text{NH}_4^+$) and orthophosphate ($\text{PO}_4^{3-}$) from the benthos in a process called “internal nutrient loading.” Such loading can induce a positive-feedback loop that further exacerbates eutrophication and lowers DO levels throughout the water column, and can create toxicity problems for many aquatic organisms such as fish that cannot tolerate elevated ammonia concentrations. For more information about existing conditions relevant to eutrophication and DO within Parsons Slough, please see Appendix C.

**Threshold of Significance - DO**

Water quality objectives for DO have been established in the *Central Coast Region Basin Plan* (Basin Plan) for several of the beneficial uses prescribed for Parsons Slough. The most conservative of those objectives specifies that DO concentrations shall not be reduced below 5.0 mg/L at any time (Central Coast RWQCB 1994). Like many estuaries, this standard is often not met due to factors such as tidal circulation, productivity, and eutrophication (see below). Monitoring data from within Parsons Slough indicate that while the system typically has DO levels within acceptable ranges, periodic events can drive extreme increases or decreases in DO (Moffatt & Nichol 2008). DO levels within Parsons Slough under existing conditions fall below 2.3 mg/L approximately 1.5
percent of the time and below 5 mg/L approximately 14.5 percent of the time (Lessa pers. comm. 2010). In consideration of these naturally occurring conditions, the Water Quality and Eutrophication Working Group, a group formed by ESNERR and tasked with developing water quality management objectives and thresholds for the long-term management of the sill, determined that alternative management scenarios for the sill should be considered if DO levels were below 2.3 mg/L more than 10 percent of the time over a two month period (D’Amore pers. comm. 2010). Members of this Working Group include water quality scientists and representatives from several regulatory and resource agencies, including the Central Coast RWQCB.

Comments:

a) Staging area and railroad embankment tie-in construction activities, such as site clearing and boat ramp/floating pier installation, could leave soils exposed to rain or surface water runoff that may carry soil contaminants (e.g., nutrients, metals, hydrocarbons, or other pollutants) into waterways adjacent to the site, degrade water quality, and potentially violate water quality standards for specific chemicals, DO, oil and grease, suspended sediment, or toxicity. Equipment used to facilitate in-water construction activities, such as pile-driving and installation of rock buttresses, could release contaminants such as oil, grease, and fuel, directly into Parsons Slough, similarly degrading water quality and violating water quality standards. Such water quality violations could pose a threat to the growth, survival, and reproduction of multiple wildlife species such as benthic invertebrates, fish, and birds. This impact would be potentially significant but would be less than significant with mitigation by development of a SWPPP and implementation of standard BMPs, in accordance with Mitigation Measure IV-1, which is described in Section IV, Biological Resources.

b) Groundwater within the Parsons basin is governed by two factors: (1) the pumping of groundwater from aquifers for agricultural and municipal use, and (2) to a much lesser extent, water surface elevations within Parsons Slough that act as a tailwater control on groundwater elevations. The proposed project would not involve pumping groundwater, so it would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. In addition, sheet pile used to construct the sill would not act as a conduit for seawater infiltration into the aquifer, as the 60 to 80 feet of clay sediment through which they would be driven would tightly seal around them. Operation of the sill would have only a minor effect on tidal elevations within Parsons Slough, and would not affect groundwater levels in uplands adjacent to the project area. The proposed project would have no impact on groundwater.

c) Implementation of the proposed project would, in a conservative analysis, reduce the existing tidal prism within Parsons Slough by less than 1 percent under both spring tide and average tidal conditions (Table VII-2). Similarly conservative estimates of post-implementation tidal velocities indicate that the sill would maintain peak existing flood tide velocities through the mainstem of Parsons Slough channel and reduce peak ebb tide velocities by 0.06 meters per second (0.2 feet per second) relative to existing conditions (Philip Williams and Associates 2010). These reductions in peak ebb tidal velocities are anticipated to reduce the average annual erosion rate in Elkhorn Slough by up to 15 percent (Philip Williams and Associates 2010).

3 Based on ESNERR data collected between August 1995 and January 2010 (Lessa pers. comm. 2010).
It is important to note that these velocities are calculated as an average across the channel cross-section. At the center of the channel cross section, above the notch in the sill, the hydraulic effects of the notch could cause tidal velocities to exceed 10 feet per second. This velocity would decrease to 3-5 feet per second, on an ebb tide, by the time the central “jet” reaches the nearest marsh shoreline, which is located about 180 feet to the west of the sill structure (Ducks Unlimited et al. 2010a). These velocities could cause erosion of an unprotected or unvegetated shoreline; however, it is anticipated that existing vegetation would reduce any potential scour effects in this area. In addition, the current in the channel at this location is turning away from the bank towards the north, which would further reduce the erosion potential at this location.

The maximum flow velocity at the UPRR bridge would increase from 3.24 feet per second under existing conditions to 3.48 feet per second with the sill in place (Ducks Unlimited et al. 2010b). These velocities represent average velocities over the entire cross-section at the bridge; local velocities near the bridge piers would be higher. However, construction of the proposed sill is not anticipated to significantly increase the potential for scour at the bridge piers, or erosion along the channel banks or bridge abutments, particularly since the existing banks and abutments are already protected with riprap erosion protection. As a conservative measure, riprap has been incorporated into the project design to protect exposed areas between the proposed sill structure and the bridge abutments. In general, project activities would decrease erosion and increase siltation on-site during spring tidal cycles relative to existing conditions (Ducks Unlimited et al. 2010a, Gentzler pers. comm. 2010).

None of these impacts would result in a significant change to the existing drainage patterns of the project area, or substantially increase the potential for erosion. In fact, erosion rates in the larger Elkhorn Slough are anticipated to be reduced by up to 15 percent. This impact would be less than significant.

d) As discussed above in (c), project activities would not substantially alter drainage patterns from the project area because construction of the sill would be in the channel and would only slightly impede flows into and out of Parsons Slough. The project would therefore not affect stormwater runoff in a way that would impact flooding either on or off-site. No impact would occur.

e) The proposed sill site lies within tidal waters. Installation of the sill would not create or contribute runoff water that would enter any stormwater drainage systems or provide substantial additional sources of polluted runoff into any such system. The small amounts of polluted runoff that may be generated at the Kirby Park staging area and dry-land railroad embankment tie-ins by construction activities are discussed in (a) above. This impact would be less than significant.

f) Installation of the sill could potentially impact water quality within a portion of the Parsons Slough channel by stratifying water along the channel bottom immediately upstream of the sill. The sill would focus tidal flows in the channel cross-section above the sill, thereby decreasing circulation of the portion of the water column that is below the sill’s invert elevation within the channel upstream of the sill. More specifically, installation of the sill could increase stratification in a topographical depression upstream of the sill where water depths are deeper than the sill crest. The most recent bathymetric survey of the project site (Ducks Unlimited et al. 2010a), identified maximum depths of -24 feet in this area, which is 19 feet below the elevation of the planned sill crest. The sill would likely create turbulence and form eddies that will help to mix the water column near the structure; however, some stratification could persist if a strong gradient in temperature keeps cold dense bottom water from mixing with warmer surface water. Turbulent mixing is the primary mechanism that would
prevent stratified conditions from developing; as such, stratification would be most likely during neap tides, when turbulent mixing is at a minimum.

Turbulent mixing is expected to impinge on the bottom of the channel within a distance of approximately 300 feet upstream of the sill, at the location of a junction of three tidal channels (Parsons Slough becomes shallower in this area, and the confluence of these channels will aid in mixing [Largay pers. comm. 2010]). The area in Parsons Slough that would potentially undergo stratification of the water column is approximately 1.5 acres, confined between the sill and the entrance of these tributary channels. Along the shallower tributaries, turbulent flow is likely to maintain a well mixed water column. Between the structure and this confluence, flow will pass by the UPRR bridge. Turbulence around this structure will also aid the mixing process.

Increased stratification in this area could potentially result in the development of low DO conditions. In the event thermal stratification occurs and a layer of poorly mixed water develops in the topographic depression upstream of the sill, oxygen depletion may occur if the rate of water exchange between the lower and upper water column is too low to counterbalance oxygen consumption by the biota and the oxidization of organic matter on the bed. Given the large water volume in the depression upstream of the sill, oxygen depletion is likely to occur gradually and during the summer months when higher water temperatures occur. Higher temperature waters have a lower capacity for DO, resulting in faster metabolic processes and higher rates of oxygen consumption.

The times of greatest risk for low DO levels are foreseeable. Periods of high temperatures are the most likely conditions under which thermal stratification of the water column is likely to develop. Seasonally, critical times would be most likely July through September. Monthly, critical times would be most likely to occur during neap tide sequences, when turbulent mixing is at a minimum. Diurnally, critical times would be expected to occur after dark, when photosynthetic organisms switch from being net oxygen producers to being net oxygen consumers, with the worst conditions just before dawn.

Construction of the sill would be completed in the winter of 2010/2011, when water quality within Elkhorn Slough is at its best. Historical data (1995-2010) from the South Marsh Water Quality Station shows that hypoxic conditions (DO levels less than 5.0 mg/L) occurred less than 0.6 percent of the time between December and February, and that anoxic levels (DO levels less than 2.3 mg/L) were not detected during this time (ESNERR SWAMP data). Nonetheless, water quality impacts from installation of the sill may be potentially significant. Implementation of the phased monitoring program associated with Mitigation Measure VIII-1 would reduce this impact to less than significant with mitigation.

Mitigation Measure VIII-1. ESNERR shall monitor pre- and post-implementation water quality parameters including temperature, salinity, pH, and DO. The monitoring will incorporate a phased approach that tracks the development of thermal stratification in the deep area near the sill and DO at a long term monitoring station in Parsons Slough, the South Marsh Water Quality Station. Details of the monitoring approach are described below.

If thermal stratification is observed, DO concentrations would be monitored in the deep area near the sill to identify whether increased hypoxia is occurring. If data indicate that areas behind the sill are experiencing periods of hypoxia (DO below 2.3 mg/L) more than 10 percent of the time over a two month period, then ESNERR would lower the sill by driving the sheet piles in the center section of the sill deeper to create a larger cross section, resulting in increased tidal exchange and mixing of bottom water. The sheet pile would
be driven into the clay materials of the channel bed with the same equipment used to build the structure, using Kirby park as a staging area. The H-piles would be cut off above the channel bed with a torch and removed from Elkhorn Slough. The rockfill buttress near the center of the sill structure would also be lowered or removed to facilitate tidal exchange. If removed, rock associated with the buttress would be placed on a barge and offloaded to trucks staged at Kirby Park. If left in place, the rock would be rearranged on the bed of the Parsons Slough Channel within the 20-foot disturbance buffer to minimize obstruction of water flow. The same staging and construction methods would be employed to lower the sill as were used to build it. Similarly, the same mitigation measures described in this document to minimize potentially significant impacts associated with construction of the sill would be implemented to minimize impacts associated with lowering the sill.

The exact amount by which the sheet pile would be lowered would be determined using the data collected prior to and following construction of the sill. That data, which will include profiles of temperature, would allow determination of the thickness of the bottom layer, if stratification exists. If increased stratification occurs, and it is determined to result in unacceptable DO concentrations (described below), analytical and numerical models of the relationship between sill height and bottom layer thickness would be developed and calibrated using this field data. Those models would be used to determine the depth to which the sill should be lowered to reduce water quality impacts to a less than significant level. ESNERR would collaborate with regulatory and resource agencies and mutually acceptable technical experts in the development of those models and the determination of the appropriate height to which the sill should be lowered.

Additional specificity on the phasing of this monitoring approach is described below. If the sill is lowered, the same monitoring approach would be conducted.

Water quality monitoring approach

1. Pre-construction water quality conditions will be characterized through a two-month deployment of pressure/temperature loggers at multiple depths, combined with periodic vertical profiling with a multi-parameter sonde, to record DO, temperature, salinity, pH, and turbidity. A mooring line with pressure/temperature loggers would be deployed in the deepest area upstream of the sill location. These instruments would provide measurements every 15 minutes at two depths, one 0.5 meter above the bottom and the other at about MLLW. High resolution vertical profiles of the water column would be executed close to the mooring site. The profiles would have depth intervals of 0.5 meter and would be carried out every hour during a period of 6 hours at the smallest neap tide in August, September, and October. At least half of the profiles would be collected during the pre-dawn hours.

Post construction conditions would initially be monitored with pressure/temperature loggers deployed in the same location and depths. They would initially be recovered weekly and swapped with two additional loggers (of the same kind), to ensure a continuous record. If no stratification is identified in the first two weeks, the instruments would be deployed for progressively longer periods, up to one month.

2. If the thermal stratification after the sill is installed exceeds conditions observed prior to construction, a second monitoring phase would be implemented. This would involve vertical profiling of the water column with a multi-parameter sonde to investigate whether other parameters, including DO, are also
becoming affected by thermal stratification. Two stations, located 100 feet and 200 feet to the east of the sill, and including the mooring site used for the thermal stratification monitoring, would be investigated during the pre-dawn hours of neap tides, following the protocol used for pre-project monitoring. This period is when the oxygen reservoir has the highest probability of being depleted.

3. If hypoxia, or a strong trend towards hypoxia over time, is detected in these profiles, then monitoring would be intensified, either with more frequent profiling (consecutive days centered on the smallest neap tide), or with the deployment of vertically staged multi-parameter sondes for continuous data collection. The deployment depth and number of sondes would be defined based on the stratification depth identified during the vertical profiles, and would be informed by the correlation between the DO levels measured in the upper water column and the South Marsh Water Quality Station.

This intensive monitoring approach would be conducted for two years following construction. If during this period stratification does not increase over pre-project conditions, and an increase in hypoxia is not observed, then long term monitoring at the South Marsh Water Quality Station would be used as a proxy for the DO levels near the sill. If at some future date hypoxia greater than 10 percent of the time is observed at the South Marsh Water Quality Station, intensive monitoring would be initiated again to assess potential stratification and, if necessary, evaluate lowering the sill according to the approach outlined above.

g) The proposed project would be located within the 100-year floodplain, whose location is determined by tidal action from the Pacific Ocean. The majority of Parsons Slough is zoned “AE,” or a high risk flood area. These areas have a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage (FEMA 2009). The proposed project would not involve any new housing or structures other than the proposed sill, and no housing would be placed in a high-risk area. The sill structure would be entirely underwater under all but the most extreme low tides; as a result, its failure would not contribute to flooding within the Parsons or Elkhorn Slough basins. Therefore the project would have no impact to flood hazards.

h) The sill structure would be located underwater; however, it would be designed to withstand the effects of tidal currents, as it is a structure designed to reduce tidal flows into and out of Parsons Slough. No impact would occur.

i) Construction of the proposed project would not expose people or structures to significant risk of loss, injury, or death involving flooding. The sill and oyster beds would function under high flood conditions. As noted above, the sill structure would be entirely underwater under all but the most extreme low tides. No impact would occur.

j) Tsunamis are triggered in a body of water by a sudden movement, such as a large-scale slump or slide, which is often caused by earthquakes, movement of the oceans crust, or large explosions. Tsunamis have extremely long wave periods and wavelengths and can travel at great speeds. The potential of a tsunami to cause great damage to coastal communities depends on coastline orientation, coastline shape, and local bathymetry. The proposed project would not expose people to inundation by Tsunami waves, nor would a Tsunami pose a significant threat to the finished sill structure. No impact would occur.
IX. LAND USE AND PLANNING

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Physically divide an established community.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the 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.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Conflict with any applicable habitat conservation plan or natural community conservation plan.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

a) The majority of the Parsons Slough Complex (except for a few tips of the Five Fingers area on the eastern side of Parsons Slough) is owned and managed by the CDFG as part of ESNERR. ESNERR operates in partnership with NOAA and the local, non-profit Elkhorn Slough Foundation (ESF). ESNERR also offers opportunities for public access and is home to an award-winning visitor’s center. The property features over 5 miles of maintained hiking trails and has boardwalks, a wildlife viewing blind, and a fully-accessible scenic overlook. Construction of the proposed project would result in the continued protection and restoration of the estuarine ecosystem and would not physically divide an established community. **No impact** would occur.

b) The project area is designated as Resource Conservation (Coastal Zone) in Monterey County’s North County Coastal Land Use Plan and the Coastal Implementation Plan, Part II. Because the proposed project would reduce the tidal prism and restore native marsh habitat to Elkhorn Slough, project activities would be consistent with the North County Coastal Land Use Plan and the Coastal Implementation Plan, Part II. In addition, because the proposed project would be located in California’s coastal zone and the Monterey Bay National Marine Sanctuary, and would have the potential to effect waters of the State and U.S., as well as special-status fish and wildlife species, it would be required to be consistent with several additional land management plans and federal / state regulations, including the Federal Coastal Zone Management Act (CZMA), California Coastal Act (CCA), Monterey County Local Coastal Program, Monterey Bay National Marine Sanctuary Final Management Plan (NOAA 2008), the Elkhorn Slough National Estuarine Research Reserve Final Management Plan 2007-2011 (ESNERR 2006), CWA, and special-status species protection laws, including the ESA, MMPA, MBTA, and California Fish and Game Code. The proposed project has been designed to be consistent with all management plans governing the project area, as well as resource protection laws, which will be verified during the permit application review process that will be overseen by the agencies with respective jurisdiction over these resources. Given that the proposed project would not conflict with any of these management plans or resource polices, **no impact** would occur.

c) CDFG’s current land management practices within the project area include long-term research, water-quality monitoring, education and coastal stewardship (ESNERR 2006). Construction activities would not decrease habitat values. The proposed project is not located within the boundaries of, nor would it conflict with, a
Natural Communities Conservation Plan or Habitat Conservation Plan. Land use within the project area would not change as a result of the proposed project. No land use plan or general plan amendments are required for this project. *No impact* would occur.
X. MINERAL RESOURCES

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant Impact with Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 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.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) 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.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

a – b) The proposed project would use typical aggregate resources in the course of construction, including rock, gravel, and sand necessary for construction of the sill and placement of rock at Kirby Park. These resources are readily available in the region and no additional sources would be required to meet the project’s demand. No significant deposits of mineral resources are present in the project area. The project area is not identified as significant for mineral resources by any federal, state, or local plans. *No impact* would occur.
**XI. NOISE**

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) For a project 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, would the project expose people residing or working in the project area to excessive noise levels.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

a, b, d) Noise sensitive receptors typically include occupants of residences, schools, religious facilities, hospitals, rest homes, and parks. Sensitive noise receptors in the general vicinity of the sill and staging area include homes/residences and Kirby Park, an established recreational area, as well as the larger Elkhorn Slough, which is used for a variety of recreational purposes (hiking, boating, fishing; refer to Section XIV, Recreation, below). The closest homes to the proposed sill site are about 1 mile away (5,280 feet) to the south-southeast. The nearest residences to the proposed Kirby Park staging area are located approximately 1,800 feet to the southeast and 1,600 feet to the northeast.

To describe noise environments and to assess impacts on noise–sensitive areas, a frequency weighting measure, which simulates human perception, is commonly used. It has been found that A–weighting of sound levels best reflects the human ear’s reduced sensitivity to low frequencies, and correlates well with human perceptions of the annoying aspects of noise. The A–weighted decibel scale (dBA)\(^5\) is cited in most noise criteria. Decibels are

---

\(^5\) A decibel (dB) is a unit of sound energy intensity. Sound waves, traveling outward from a source, exert a sound pressure level (commonly called “sound level”) measured in dB. An A–weighted decibel (dBA) is a decibel corrected for the variation in frequency response to the typical human ear at commonly encountered noise levels.
logarithmic units that conveniently compare the wide range of sound intensities to which the human ear is sensitive. Table XI–1 identifies typical ranges of decibel levels for common sounds heard in the environment.

**Table XI-1  Typical Noise Levels**

<table>
<thead>
<tr>
<th>Noise Level (dBA)</th>
<th>Outdoor Activity</th>
<th>Indoor Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>90+</td>
<td>Gas lawn mower at 3 feet, jet flyover at 1,000 feet</td>
<td>Rock Band</td>
</tr>
<tr>
<td>80–90</td>
<td>Diesel truck at 50 feet at 50 miles per hour</td>
<td>Food blender at 3 feet; garbage disposal at 3 feet</td>
</tr>
<tr>
<td>70–80</td>
<td>Gas lawn mower at 100 feet, noisy urban area (daytime)</td>
<td>Vacuum cleaner at 10 feet</td>
</tr>
<tr>
<td>60–70</td>
<td>Commercial area; heavy traffic at 300 feet</td>
<td>Normal speech at 3 feet</td>
</tr>
<tr>
<td>50–60</td>
<td>Quiet urban daytime</td>
<td>Dishwasher in next room, large business office</td>
</tr>
<tr>
<td>40–50</td>
<td>Quiet urban nighttime</td>
<td>Theater, large conference room (background)</td>
</tr>
<tr>
<td>30–40</td>
<td>Quiet suburban nighttime</td>
<td>Library</td>
</tr>
<tr>
<td>20–30</td>
<td>Quiet rural nighttime</td>
<td>Bedroom at night, concert hall (background)</td>
</tr>
<tr>
<td>10–20</td>
<td></td>
<td>Broadcast / recording studio</td>
</tr>
<tr>
<td>0</td>
<td>Lowest threshold of human hearing</td>
<td>Lowest threshold of human hearing</td>
</tr>
</tbody>
</table>

Source: (modified from ICF Jones & Stokes 2009)

The assessment of the potential impacts of construction noise on sensitive noise receptors is based on a comparison of anticipated noise levels relative to the Monterey County Municipal Code (Section 10.60.030), which states that construction-related (short-term) noise should be managed to reduce impacts on adjacent land uses, and prohibits construction noise levels from exceeding 85 decibels (A-weighted) (dBA) at 50 feet. This prohibition does not apply to aircraft, or to machines, mechanisms, devices, or contrivances operated in excess of 2,500 feet from any occupied dwelling unit (Monterey County 2009). This is because noise levels would typically dissipate below audible changes beyond that distance.

Construction activities associated with the proposed project would result in a temporary increase in noise at Kirby Park as a result of equipment staging and construction traffic. Similarly, construction of the sill would result in temporary noise and vibration increases associated with the operation of construction equipment and installation of sheet piles.

At Kirby Park, staging activities would cause noise primarily from commuting workers and from trucks needed to bring materials to the staging site and to the docked vessels. Trucks and on-road vehicles would arrive at the landing site via Elkhorn Road, the only available access route. The peak noise levels associated with passing trucks and commuting worker vehicles would be approximately 70 to 75 dBA at 50 feet. With the exception of workers commuting to the construction site or Kirby Park, all construction traffic, including trucks and heavy equipment, would only occur during regular daylight working hours (7 am to 6 pm), minimizing the potential for nighttime traffic noise.

These temporary construction noise levels at Kirby Park would not exceed the Monterey County Noise Control Ordinance level of 85 dBA at 50 feet. In addition, given an approximately 6 dBA noise reduction per each
doubling of distance from the source, project construction noise at the nearest residences (located 1,600 feet northeast of Kirby Park) would be below 60 dBA.

Of particular concern could be noise from sheet pile driving that would occur at the sill location, especially nighttime sheet pile driving, which could occur on up to 20 consecutive nights. Pile driving noise typically range from about 90-115 dBA for impact drivers to about 70-90 dBA for vibratory drivers at 50 feet from the source (TESPA 2001). Although vibratory hammers would be used to the extent possible, impact hammers may be used to install end bearing piles at the sill location. Given that noise is diminished by 6 dBA for each doubling of distance, under a worst case scenario, a noise level of 115 dBA would be reduced to approximately 65 dBA at a distance of about 1 mile from source (the location of the closest residence to the sill site).

Although these noise levels would exceed the Monterey County Noise Control Ordinance’s 85 dBA limit at 50 feet, the proposed project would be in compliance with the Noise Ordinance because noise sources would be “machines, mechanisms, devices, or contrivances operated in excess of 2,500 feet from any occupied dwelling unit (Monterey County 2009)” At this distance, project noise would not be expected to be noticeable above background noise. In addition, construction activities would occur in the winter months, when local residents are less likely to be outside late at night, or sleeping with their windows open, further decreasing the likelihood that they would be exposed to prolonged periods of construction noise.

Still, there is some potential that construction noise could disturb sensitive human receptors. Mitigation Measure XI-1 would assure that potential construction noise impacts to sensitive human receptors would be reduced to less than significant with mitigation.

**Mitigation Measure XI-1:** The construction contractor shall prepare a Noise Control Plan, subject to County review, to ensure that construction activities would not exceed 85 dBA within 50 feet of a sensitive receptor. The Noise Control Plan shall include identification of any sensitive receptors; work hour limitations for certain types of noisy activities; requirements for noise control and noise shielding features on construction equipment; specifications for activities at project staging and construction areas; conditions on delivery timing to control delivery truck noise; and identification of contacts and procedures for addressing noise complaints. Use of proper mufflers on equipment engines and enclosing engines or mounting noise shields around noisy equipment shall be included in the project contract specifications, and minimize the likelihood of exceeding the threshold.

Furthermore, OSHA regulations require that a project-specific health and safety plan be developed prior to any construction activities by the construction contractor to identify any noise levels that would expose workers to unsafe noise levels. Any required noise-protection measures identified in the health and safety plan would be implemented to protect workers at the site.

c) No permanent increase in ambient noise would result from the proposed project. **No impact** would occur.

e) The project area is not located within 2 miles of a public airport or in an area with an airport land use plan. Project activities would not expose people residing or working in the project area to excessive noise levels. **No impact** would occur.

f) The project area is located 1.75 miles west of a private airstrip. Project activities would not subject additional people to aircraft noise. **No impact** would occur.
XII. POPULATION AND HOUSING

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure).</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Displace substantial numbers of existing housing units, necessitating the construction of replacement housing elsewhere.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

a – c) The proposed project would neither create an additional demand for housing nor displace any people from existing housing. The proposed project would not add any housing to the vacant, residentially zoned parcels, nor would any housing be demolished. The proposed project would not result in the creation of any new jobs or create a demand for additional long-term employees. Construction of the proposed project would be handled by temporary contracted workers, most of whom would be locally based. These contracted jobs would not result in long-term employment or population growth and, therefore, would not affect the demand for housing nor the availability of housing in the local area or region. Similarly, maintenance of project facilities (sill, oyster reefs) would not directly result in an increase of long-term jobs since these facilities would be maintained by existing ESNERR staff. *No impact* would occur.
XIII. PUBLIC SERVICES

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant Impact With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 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 following public services:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Fire protection. X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii) Police protection. X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii) Schools. X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv) Parks. X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v) Other public facilities. X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The proposed project is not expected to create any temporary or long-term demands on public services. There would be no new fire protection, police, school, or other public facilities constructed to serve the proposed project, and the project would have **no impact** on these resources. The Kirby Park parking area would be temporarily impacted during construction activities; however, project activities would not generate additional park users, and all temporarily disturbed facilities would be restored upon completion of the project. As a result, there would be a **less than significant impact** on parks facilities.
### XIV. RECREATION

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Increase 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.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

a – b) Recreational resources within the proposed project area include Kirby Park (recreational boating, kayaking, hunting, fishing) and Elkhorn Slough (kayaking, bird watching, hunting, fishing). There are established hiking trails located throughout the project area that are accessible to recreational users during daytime hours. A randomized survey of local visitors to Elkhorn Slough and the Moss Landing area was conducted in the summer of 2008 (Kildow and Pendleton 2010). Of the 308 people surveyed, 65 people (21 percent) stated that they used Kirby Park, primarily for kayaking, hiking, and walking purposes. Other use data for Kirby Park is not available.

Recreational activities could be temporarily disrupted by construction activities and construction noise at the Kirby Park staging area, in Elkhorn Slough (barges traveling through main channel to sill site), and at the sill site construction area. Portions of the Kirby Park parking lot and the existing boat ramp would be unavailable to the public during the 3 to 4 month construction period. Implementation of Mitigation Measure XIV-1 would minimize potential impacts on the public access opportunities at Kirby Park during construction. In addition, implementation of Mitigation Measure XIV-2 would minimize any confusion associated within changes in public access during construction, and would inform the public of alternative sites available for their use. In consideration of the temporary nature of construction activities and provisions to allow continued use of facilities at Kirby Park, potentially significant construction-related impacts to recreation facilities would be reduced to *less than significant with mitigation*.

To maintain the long-term functionality of the parking area at Kirby Park, reduce hazards to people using the parking lot, and to minimize the potential for erosion in the future, at locations temporarily disturbed during construction, ESNERR would remove portions of degraded pavement, recontour those areas for a more appropriate transition to intertidal mudflat, and install large rocks to protect the bank and minimize future erosion. Improvements would be confined to the portion of the parking area that was paved prior to construction activities, or areas covered by gravel roadbase and that are located above MHW (4.8 feet); placement of rock would not extend into the adjacent intertidal mudflat. This effort would impact an area approximately 400 feet long and 5 to 10 feet wide, and would result in a minimal reduction in the paved area available for parking at Kirby Park. Overall, these improvements would increase the long-term viability of Kirby
Park, whose parking facilities have significantly degraded over time, and would result in a **less than significant** impact.

The proposed project would not require expansion or construction of recreational facilities. Watercraft are currently prohibited from accessing Parsons Slough (they are not allowed east of the UPRR bridge). Signage to remind the public of these restrictions would be installed at the confluence of Parsons Slough Channel and Elkhorn Slough, about 800 feet downstream of the sill location. In addition, a buoy line or similar feature would be built across the Parsons Slough Channel on the Elkhorn Slough side of the structure to prevent boaters from approaching the structure during construction and to make boaters aware of its presence after the sill is operational. This signage and buoy line would be placed about 100-feet downstream of the sill to provide boaters with ample warning of the location of the sill.

Installation of the sill would not impact recreational uses, as Parsons Slough is currently not open to watercraft or recreational use due to the sensitive nature of natural resources in the area. All impacts on recreation facilities would be temporary, as described above, and would be **less than significant with mitigation**, with implementation of Mitigation Measures XIV-1 and XIV-2.

**Mitigation Measure XIV-1**: A temporary 10-foot wide by 40-foot long floating dock and a 10-foot wide gravel boat ramp will be constructed for public use at the north end of the Kirby Park parking lot during construction (Figure 4). The boat ramp and dock would be installed at Kirby Park before access to the existing boat ramp is limited by construction, and would be removed when construction is complete and the existing boat ramp has been returned to working order.

**Mitigation Measure XIV-2**: Signs shall be posted at Kirby Park prior to construction to notify the public of construction staging at Kirby Park and to make them aware of the temporary dock and boat ramp that would be provided at the north end of the parking lot. The sign shall also include a map identifying the alternate, public boat ramp located at the North Moss Landing Harbor. Kayak rental services and other tour boat operators in the area shall be notified of this temporary change in access to Kirby Park at least three months before construction would commence. Interpretive signage explaining the purpose and environmental considerations associated with the proposed project shall be placed near the sill site (either at the entrance to Parsons Slough or at the sill itself) and at the Kirby Park parking lot to assist the public in understanding the function of the sill. Fact sheets and interpretive literature about the sill also shall be provided to all boat rental and excursion operators free of charge.
### XV. TRANSPORTATION AND TRAFFIC

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Exceed the capacity of the existing circulation system, based on applicable measures of effectiveness (as designated in a general plan policy, ordinance, etc.), taking into account all relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>b) Conflict with an applicable congestion management program, including but not limited to, level of service standards and travel demand measures and other standards established by the county congestion management agency for designated roads or highways</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>c) 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.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>d) Substantially increase hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment).</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>e) Result in inadequate emergency access.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>f) Result in inadequate parking capacity.</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks).</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Comments:**

a – e) The proposed project would involve transport of rock from a regional provider such as Graniterock, which is located approximately 20 miles southeast of the project area on Highway 101. Construction vehicles from Highway 101 north of the project site would travel to Kirby Park by taking Highway 129 west to County Road G12 south (left turn) and south again (right turn) on Elkhorn Road. Construction vehicles from Highway 101 south of the project site would travel to Kirby Park by Highway 183 west to Highway 1 North (right turn), Salinas Road East (right turn) to Werner Road east (veer right), south on County Road G12 (right turn) and south again on Elkhorn Road (right turn). This would avoid the less rural and more hazardous southern section of Elkhorn Road. Other construction vehicles coming from the north on Highway 1 would exit Highway 129 east and then turn south (right) on County Road G12 to avoid making a left turn across a dangerous intersection of Highway 1. These access routes are common large truck routes in the area and provide the least disruptive route to Kirby Park avoiding hazardous turns and intersections.
Materials would be stored at Kirby Park and transported by barge to the sill construction site. Materials for construction of the artificial oyster reefs (clam shells and mud) would be derived from various locations within Elkhorn Slough (e.g., majority of clam shells located at the mouth of Elkhorn Slough where sea otters forage) and transported to the restoration site by ESNERR staff on internal roads.

Truck traffic to the Kirby Park staging area is expected to be limited to a few trips per hour at the peak (about 12 trips per day). In addition, fewer than 20 construction workers would drive to the staging area daily during the construction period. As a result, project traffic would not impact traffic on Highway 1 or other roads in the vicinity of the project. Large trucks or wide loads that could result in potential traffic hazards would be adequately flagged and, if necessary, accompanied by flag vehicles to assure no traffic conflicts. Anticipated traffic would not impact programs supporting alternative transportation, or result in increased access restrictions in event of an emergency. This impact would be less than significant.

f) The parking lot at Kirby Park provides space for approximately 60 to 100 vehicles, with 60 marked parking spaces. The addition of construction worker vehicles would reduce available parking by approximately 20 percent during the 3 to 4 month construction period. This is not considered a significant impact on parking because the current capacity at Kirby Park exceeds daily use by park visitors. Currently, no more than 20 vehicles are parked at Kirby Park at any one time on most days. This impact would be less than significant.

g) Introduction of construction vehicles to the area would not conflict with any adopted policies, plans, or programs supporting alternative transportation. Therefore the project would have no impact on alternative transportation.
XVI. UTILITIES AND SERVICE SYSTEMS

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>g) Comply with federal, state, and local statutes and regulations related to solid waste.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Comments:

Utility lines and infrastructure within the project area are limited to overhead power lines and a buried fiber optic cable line. Five overhead power lines cross portions of Parsons Slough. All power lines enter the project area from the southwest corner, originating from the Moss Landing plant and trending north, northeast, and east across the project area. One overhead line crosses the east side of Parsons Slough and extends to the north along the eastern portion of South Marsh. Two more overhead lines extend northeast across Parsons Slough, and two other overhead lines extend east across the project area. All are high voltage lines that would be avoided by any project work. A fiber optic cable line exists within the UPRR rail corridor right of way buried within the levee along the east side of the track. Project construction would be designed to avoid this line. No new or additional utilities or service systems would be required to serve the site as a result of this project.

a – c) The proposed project would not generate any wastewater. As such, it would not exceed any wastewater treatment requirements, require construction of new wastewater treatment or storm water drainage facilities, or result in the expansion of existing facilities. No impact would occur.

d) The proposed project would not have any demand for water. No impact would occur.
e) The proposed project would not increase demand associated with wastewater treatment facilities because it would not generate any wastewater. *No impact* would occur.

f - g) Small amounts of solid waste would be generated during construction and would be hauled to an approved landfill. The proposed project would comply with federal, state, and local statutes and regulations related to solid waste. This impact would be *less than significant*. 
XVII. MANDATORY FINDINGS OF SIGNIFICANCE

<table>
<thead>
<tr>
<th>Environmental Factors and Focused Questions for Determination of Environmental Impact</th>
<th>YES: Potentially Significant Impact</th>
<th>NO: Less Than Significant With Mitigation</th>
<th>NO: Less Than Significant Impact</th>
<th>NO: No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major Periods of California history or prehistory?</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>b) Does the project have impacts that are individually limited, but cumulatively considerable? (&quot;Cumulatively considerable&quot; means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Comments:

a) Potentially significant effects on environmental quality, including impacts to biological resources, cultural resources, geology and soils, hydrology/water quality, noise, and recreation are identified in the preceding sections of this Initial Study. As detailed in this document, those impacts would be less than significant with mitigation with the implementation of measures identified in this Initial Study.

b) CEQA Guidelines (Section 15355[b]) define cumulative impacts as those resulting from closely related past, present, and reasonably foreseeable projects. CEQA Guidelines (Section 15125[a]) also define the analytical baseline as the conditions on the ground at the time that the Initial Study is prepared. Impacts of past projects are generally considered as part of these baseline conditions. A number of projects are planned or approved in and around the project area. These include:

- **Moss Landing Wildlife Area Phase 2 Project** – CDFG project on a managed wildlife area with goals to maximize habitat variety and quality for nesting and foraging birds, particularly breeding and rearing habitat for the Western snowy plover; provide additional opportunities for wildlife viewing; improve public access; and create access compliant with the Americans with Disabilities Act.

- **Triple M Ranch Wetland Restoration Project** – Restoration project to improve water quality, restore sensitive and special-status species habitat, and demonstrate compatibility between natural areas and production farming. The project site would be located in the Elkhorn Slough watershed east of Sill Road and south of Hall Road.
- **Azevedo Ponds Restoration Project** - Replace two water control structures for the purpose of improving water quality to a 13-acre wetland on land owned by The Nature Conservancy. Project implementation will be complete in Spring 2010.

- **Moss Landing Sanctuary Scenic Trail** – This project would be a component of the Monterey Bay Sanctuary Scenic Trail, and would extend about 1.17 miles from Moss Landing Road to Jetty Road. It would include construction of a new bridge over the mouth of Elkhorn Slough just west of the Highway 1 bridge. About 0.8 miles have already been constructed.

- **Moss Landing Harbor District / USACE maintenance dredging** – Regular maintenance dredging that occurs every 2 to 4 years.

- **Pilot Desalination Plant** - A proposed small, temporary pilot desalination plant on Highway 1 in Moss Landing.

- **Cal-Am Desalination Plant** – This project would include construction of a desalination plant sized to produce 10 million gallons per day of desalinated water. It would also include a seawater intake system using source water supplied from the existing Moss Landing Power Plant, an open-water brine discharge system through the Moss Landing Power Plant, and a variety of conveyance and storage facilities, including 28 miles of pipeline and an aquifer storage and recovery system. Two alternate locations are being considered for the proposed desalination plant: on 16-acres at the Moss Landing Power Plant or on 10 acres at the Armstrong Ranch (near the Monterey Regional Water Pollution Control Agency in North Marina). This project is scheduled for consideration by the California Public Utility Commission in May of 2010.

- **Moss Landing - Crazy Horse Power Line Reconductoring Project** – This project would add 477 steel-supported aluminum conductors and 10 miles of new wiring from the Moss Landing substation to a new Crazy Horse Substation at Lagunitas Junction in Prunedale, between Moss Landing and Salinas. In order to maintain minimum ground clearance as required by the Commission’s General Order 95, approximately 16 towers would be raised approximately 10 feet, and 2 towers located in pastureland would be raised approximately 15 feet. The project is designed to avoid sensitive biological and cultural resources.

- **Union Pacific Railroad Bridge Replacement** - Replace the railroad bridge at the entrance to Parsons Slough (completed in 2004; adjacent to Project site).

- **Moss Landing Harbor District Improvements** – Construction of a storage yard for fishing equipment, 40 parking spaces, and a trail on the southeast corner of Sandholt Bridge in Moss Landing.

- **National Refractories Site** – General development plan for 189 acres of an existing industrial site and construction of a 70,000 square foot warehouse at that site at the southeast corner of Dolan Road and Highway 1 in Moss Landing.

- **Monterey Bay Aquarium Research Facilities** – Construction of a new pier, 58,655 square foot research facility, a 34,000 square foot replacement of existing building, a 65,000 square foot scientific support building, and a 7,500 square foot dockhouse.

- **Gregg Drilling** – Construction of a 8,000 to 9,000 square foot building to house facilities to support remote drilling and data collection operations.
Many of the project summarized above are upland and berthing development projects that would be located in and around the town of Moss Landing. With the exception of a very minor overlap of potential construction truck traffic, the proposed project would have no potential for cumulative impacts with these upland projects because most of the effects of the proposed project would be within Parsons Slough, which none of the other projects would affect. Several additional restoration projects have been planned, approved, or recently implemented in the project area, as noted above. The proposed restoration projects in the Elkhorn Slough watersheds may have similar temporary construction impacts to those of the proposed project, but would not overlap in time or location.

The transmission line project (i.e., the Crazy Horse Power Line Recconductoring Project) would not have impacts that overlap those of the proposed project. Similarly, the proposed new desalination plant projects (both the pilot project and the Cal-Am project) project would not have impacts that overlap those of the proposed project because they would use cooling water from the Moss Landing Power Plant facility and, therefore, would not increase intake water impacts. If the proposed desalination projects were to increase intake water pumping (not currently proposed), there could be some overlapping effects on fish and marine mammals; however, the proposed project’s contribution to this cumulative impact would be minimal because of its distance from the power plant intake and its inherent minimal effect on aquatic species.

The proposed project would not contribute substantively to any cumulative adverse environmental impacts. Cumulative impacts would be less than significant.

c) As described in this IS, the proposed project would not result in health risks or substantial emissions of air pollutants. It would have no effects to utilities or services. Noise impacts would be short-term and reduced to less than significant levels by restrictions on maximum daytime and nighttime noise levels. Impacts to recreation would not be significant because of the temporary nature of the impact and availability of alternate public access to Elkhorn Slough during construction. The proposed project would have a less than significant impact on environmental factors that could cause substantial adverse effects on human beings, either directly or indirectly.
F. SOURCES

Personal Communication


D’Amore, N, Parsons Slough Project Adaptive Management Lead. 2010. Phone and email correspondence between D’Amore, ESNERR, and April Zohn, Lux Environmental Consulting, LLC, regarding the DO monitoring thresholds for the Parsons Slough Project. March.

Gentzler, S., Hydrology and Hydraulics Group Manager. 2010. Email correspondence between Gentzler, URS Corporation, and April Zohn, Lux Environmental Consulting, regarding updated tidal prism and habitat estimates (Tables 7-1 and 7-2 in Ducks Unlimited et al. 2010a) based on revised tidal datums. March 2.


Holm, C., Assistant Planning Director. 2010. Phone conversation with Holm, Monterey County, and Richard Grassetti, Grassetti Environmental Consulting, regarding the status of the Monterey County General Plan. March 2.

Largay, B., Tidal Wetland Project Director. 2009. Email communication between Largay, Tidal Wetland Project, and Vinnedge Environmental Consulting Project Team. November and December.

________. 2010. Email correspondence between Largay and Brook Vinnedge, Vinnedge Environmental Consulting, on the anticipated stratification effects of the proposed sill in Parsons Slough Channel. Provided in comments on administrative draft IS. March.

Lessa, G., Water Quality Specialist. 2010. Email communication between Lessa, ESNERR, and April Zohn, Lux Environmental Consulting, LLC, regarding DO levels in Parsons Slough. March 8.

Stevens, William. NMFS. 2010. Phone conversation between Mike Podlech and Bill Stevens regarding green sturgeon presence in Parsons Slough. May 14.

VanDyke, E., GIS Specialist. 2009. Email communication between VanDyke, ESNERR, and Christina Toms, Wetlands and Water Resources. December.


________. 2010b. Email correspondence between Wasson, ESNERR, and Brook Vinnedge, Vinnedge Environmental Consulting, on relative abundance of shorebirds in Parsons Slough compared to Elkhorn Slough and quality of shorebird habitat. Provided in comments on administrative draft IS. March.
Literature Cited


________. 2008b. Monterey Bay Unified Air Pollution Control District (MBUAPCD), CEQA Air Quality Guidelines. February.


LIST OF PREPARERS

Lead Agency
California Department of Fish and Game
1234 East Shaw Avenue
Fresno, California 93710
Contact: Linda Connolly

Initial Study Authors

<table>
<thead>
<tr>
<th>Author</th>
<th>Affiliation</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brook Vinnedge</td>
<td>Principal and Wildlife Biologist, Vinnedge</td>
<td>Project Manager and Biological Resources (Wildlife and Plants)</td>
</tr>
<tr>
<td></td>
<td>Environmental Consulting</td>
<td></td>
</tr>
<tr>
<td>April Zohn</td>
<td>Principal and Environmental Regulatory Specialist, Lux Environmental Consulting, LLC</td>
<td>Project Manager and CEQA Review</td>
</tr>
<tr>
<td>Richard Grassetti</td>
<td>Principal, Grassetti Environmental Consulting</td>
<td>CEQA Review, Aesthetics, Land Use and Planning, Noise, Recreation, Transportation and Traffic</td>
</tr>
<tr>
<td>Mike Podlech</td>
<td>Biological Resources (Fisheries)</td>
<td></td>
</tr>
<tr>
<td>Christina Toms</td>
<td>Ecological Engineer, Wetlands and Water Resources, Inc.</td>
<td>Geology and Soils, Hydrology and Water Quality</td>
</tr>
<tr>
<td>Jane Steven</td>
<td>Principal and Air Quality Specialist, JAS</td>
<td>Air Quality</td>
</tr>
<tr>
<td></td>
<td>Ecological Consulting</td>
<td></td>
</tr>
<tr>
<td>Miley Holman</td>
<td>Principal and Archaeologist, Holman &amp; Associates</td>
<td>Cultural Resources</td>
</tr>
<tr>
<td>Stacy McDowell</td>
<td>Word Processing</td>
<td></td>
</tr>
<tr>
<td>Leigh Etheridge</td>
<td>GIS Analyst, Wetlands and Water Resources, Inc.</td>
<td>Graphic Support</td>
</tr>
</tbody>
</table>
APPENDIX A

AIR QUALITY CALCULATIONS

Appendix A Contents:

Urbemis Combined Summer Emissions Report – 4 pages
Urbemis Combined Winter Emissions Report – 4 pages
Urbemis Combined Annual Emissions Report – 2 pages
Marine Vessel Calculations – 2 pages
Greenhouse Gas (GHG) Emissions Calculations – 1 page
## Combined Summer Emissions Reports (Pounds/Day)

**File Name:** C:\Users\Lois\Documents\Lois\Miller Envt Inc\Parsons\Parsons.urb924  
**Project Name:** Parsons Slough  
**Project Location:** Monterey County  

**On-Road Vehicle Emissions Based on:** Emfac2007 V2.3 Nov 1 2006  
**Off-Road Vehicle Emissions Based on:** OFFROAD2007

### Summary Report:

#### CONSTRUCTION EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10 Dust</th>
<th>PM10 Exhaust</th>
<th>PM10</th>
<th>PM2.5 Dust</th>
<th>PM2.5 Exhaust</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 TOTALS (lbs/day unmitigated)</td>
<td>5.60</td>
<td>48.31</td>
<td>21.49</td>
<td>0.00</td>
<td>0.81</td>
<td>2.34</td>
<td>3.15</td>
<td>0.17</td>
<td>2.15</td>
<td>2.32</td>
<td>4,889.58</td>
</tr>
</tbody>
</table>

#### AREA SOURCE EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.27</td>
<td>0.07</td>
<td>3.11</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>36.02</td>
</tr>
</tbody>
</table>

#### OPERATIONAL (VEHICLE) EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.02</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.45</td>
</tr>
</tbody>
</table>

#### SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.29</td>
<td>0.07</td>
<td>3.12</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>36.47</td>
</tr>
</tbody>
</table>
CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

<table>
<thead>
<tr>
<th>Time Slice 9/6/2010-12/31/2010</th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10 Dust</th>
<th>PM10 Exhaust</th>
<th>PM10</th>
<th>PM2.5 Dust</th>
<th>PM2.5 Exhaust</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Days: 85</td>
<td>5.60</td>
<td>48.31</td>
<td>21.49</td>
<td>0.00</td>
<td>0.81</td>
<td>2.34</td>
<td>3.15</td>
<td>0.17</td>
<td>2.15</td>
<td>2.32</td>
<td>4,889.58</td>
</tr>
<tr>
<td>Mass Grading 09/06/2010-12/31/2010</td>
<td>5.60</td>
<td>48.31</td>
<td>21.49</td>
<td>0.00</td>
<td>0.81</td>
<td>2.34</td>
<td>3.15</td>
<td>0.17</td>
<td>2.15</td>
<td>2.32</td>
<td>4,889.58</td>
</tr>
<tr>
<td>Mass Grading Dust</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Mass Grading Off Road Diesel</td>
<td>5.44</td>
<td>47.29</td>
<td>18.81</td>
<td>0.00</td>
<td>0.00</td>
<td>2.30</td>
<td>2.30</td>
<td>0.00</td>
<td>2.12</td>
<td>2.12</td>
<td>4,631.05</td>
</tr>
<tr>
<td>Mass Grading On Road Diesel</td>
<td>0.06</td>
<td>0.82</td>
<td>0.31</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>0.04</td>
<td>0.00</td>
<td>0.03</td>
<td>0.03</td>
<td>100.28</td>
</tr>
<tr>
<td>Mass Grading Worker Trips</td>
<td>0.10</td>
<td>0.20</td>
<td>2.38</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>158.26</td>
</tr>
</tbody>
</table>

Phase Assumptions

Phase: Mass Grading 9/6/2010 - 12/31/2010
Total Acres Disturbed: 0.18
Maximum Daily Acreage Disturbed: 0.04
Fugitive Dust Level of Detail: Default
20 lbs per acre-day
On Road Truck Travel (VMT): 23.66
Off-Road Equipment:
2 Cranes (399 hp) operating at a 0.43 load factor for 12 hours per day
1 Other General Industrial Equipment (238 hp) operating at a 0.51 load factor for 8 hours per day
2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 12 hours per day
1 Water Trucks (189 hp) operating at a 0.5 load factor for 12 hours per day
Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

<table>
<thead>
<tr>
<th>Source</th>
<th>ROG</th>
<th>NOX</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM25</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sill</td>
<td>0.02</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.42</td>
</tr>
<tr>
<td>Reef</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
</tr>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.02</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2011  Temperature (F): 70  Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Acreage</th>
<th>Trip Rate</th>
<th>Unit Type</th>
<th>No. Units</th>
<th>Total Trips</th>
<th>Total VMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sill</td>
<td>0.03</td>
<td>1000 sq ft</td>
<td>3.20</td>
<td>0.10</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Reef</td>
<td>0.01</td>
<td>1000 sq ft</td>
<td>0.60</td>
<td>0.01</td>
<td>0.03</td>
<td></td>
</tr>
</tbody>
</table>

Vehicle Fleet Mix

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Percent Type</th>
<th>Non-Catalyst</th>
<th>Catalyst</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Auto</td>
<td>45.2</td>
<td>1.1</td>
<td>98.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Light Truck &lt; 3750 lbs</td>
<td>16.0</td>
<td>1.9</td>
<td>93.1</td>
<td>5.0</td>
</tr>
<tr>
<td>Light Truck 3751-5750 lbs</td>
<td>20.4</td>
<td>1.0</td>
<td>98.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Med Truck 5751-8500 lbs</td>
<td>9.5</td>
<td>0.0</td>
<td>100.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Vehicle Type</td>
<td>Percent Type</td>
<td>Non-Catalyst</td>
<td>Catalyst</td>
<td>Diesel</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------</td>
<td>--------------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>Lite-Heavy Truck 8501-10,000 lbs</td>
<td>1.5</td>
<td>0.0</td>
<td>73.3</td>
<td>26.7</td>
</tr>
<tr>
<td>Lite-Heavy Truck 10,001-14,000 lbs</td>
<td>0.9</td>
<td>0.0</td>
<td>55.6</td>
<td>44.4</td>
</tr>
<tr>
<td>Med-Heavy Truck 14,001-33,000 lbs</td>
<td>1.3</td>
<td>0.0</td>
<td>23.1</td>
<td>76.9</td>
</tr>
<tr>
<td>Heavy-Heavy Truck 33,001-60,000 lbs</td>
<td>0.5</td>
<td>0.0</td>
<td>20.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Other Bus</td>
<td>0.2</td>
<td>0.0</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Urban Bus</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>3.5</td>
<td>62.9</td>
<td>37.1</td>
<td>0.0</td>
</tr>
<tr>
<td>School Bus</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Motor Home</td>
<td>0.9</td>
<td>0.0</td>
<td>88.9</td>
<td>11.1</td>
</tr>
</tbody>
</table>

| Travel Conditions |
|--------------------|----------------|
| Residential        | Commercial     |
| Urban Trip Length (miles) | 11.8 | 11.8 |
| Rural Trip Length (miles) | 11.8 | 11.8 |
| Trip speed (mph)    | 30.0 | 30.0 |
| % of Trips - Residential | 32.9 | 49.1 |

<table>
<thead>
<tr>
<th>% of Trips - Commercial (by land use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sill</td>
</tr>
<tr>
<td>Reef</td>
</tr>
</tbody>
</table>
## Experimental Report:

### Combined Winter Emissions Reports (Pounds/Day)

#### File Name: C:\Users\Lois\Documents\Lois\Miller Env't Inc\Parsons\Parsons.urb924

#### Project Name: Parsons Slough

#### Project Location: Monterey County

#### On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

#### Off-Road Vehicle Emissions Based on: OFFROAD2007

### Summary Report:

#### Construction Emission Estimates

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10 Dust</th>
<th>PM10 Exhaust</th>
<th>PM10</th>
<th>PM2.5 Dust</th>
<th>PM2.5 Exhaust</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 TOTALS (lbs/day unmitigated)</td>
<td>5.60</td>
<td>48.31</td>
<td>21.49</td>
<td>0.00</td>
<td>0.81</td>
<td>2.34</td>
<td>3.15</td>
<td>0.17</td>
<td>2.15</td>
<td>2.32</td>
<td>4.889.58</td>
</tr>
</tbody>
</table>

#### Area Source Emission Estimates

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.02</td>
<td>0.03</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>30.40</td>
<td></td>
</tr>
</tbody>
</table>

#### Operational (Vehicle) Emission Estimates

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.44</td>
<td></td>
</tr>
</tbody>
</table>

#### Sum of Area Source and Operational Emission Estimates

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.00</td>
<td>0.00</td>
<td>30.84</td>
<td></td>
</tr>
</tbody>
</table>
3/3/2010 5:45:01 PM

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10 Dust</th>
<th>PM10 Exhaust</th>
<th>PM10</th>
<th>PM2.5 Dust</th>
<th>PM2.5 Exhaust</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Slice 9/6/2010-12/31/2010</td>
<td>5.60</td>
<td>48.31</td>
<td>21.49</td>
<td>0.00</td>
<td>0.81</td>
<td>2.34</td>
<td>3.15</td>
<td>0.17</td>
<td>2.15</td>
<td>2.32</td>
<td>4,889.58</td>
</tr>
<tr>
<td>Active Days: 85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass Grading 09/06/2010-12/31/2010</td>
<td>5.60</td>
<td>48.31</td>
<td>21.49</td>
<td>0.00</td>
<td>0.81</td>
<td>2.34</td>
<td>3.15</td>
<td>0.17</td>
<td>2.15</td>
<td>2.32</td>
<td>4,889.58</td>
</tr>
<tr>
<td>Mass Grading Dust</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.80</td>
<td>0.00</td>
<td>0.80</td>
<td>0.17</td>
<td>0.00</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>Mass Grading Off Road Diesel</td>
<td>5.44</td>
<td>47.29</td>
<td>18.81</td>
<td>0.00</td>
<td>0.00</td>
<td>2.30</td>
<td>2.30</td>
<td>0.00</td>
<td>2.12</td>
<td>2.12</td>
<td>4,631.05</td>
</tr>
<tr>
<td>Mass Grading On Road Diesel</td>
<td>0.06</td>
<td>0.82</td>
<td>0.31</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>0.04</td>
<td>0.00</td>
<td>0.03</td>
<td>0.03</td>
<td>100.28</td>
</tr>
<tr>
<td>Mass Grading Worker Trips</td>
<td>0.10</td>
<td>0.20</td>
<td>2.38</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>158.26</td>
</tr>
</tbody>
</table>

Phase Assumptions

Phase: Mass Grading 9/6/2010 - 12/31/2010
Total Acres Disturbed: 0.18
Maximum Daily Acreage Disturbed: 0.04
Fugitive Dust Level of Detail: Default
20 lbs per acre-day
On Road Truck Travel (VMT): 23.66

Off-Road Equipment:
2 Cranes (399 hp) operating at a 0.43 load factor for 12 hours per day
1 Other General Industrial Equipment (238 hp) operating at a 0.51 load factor for 8 hours per day
2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 12 hours per day
1 Water Trucks (189 hp) operating at a 0.5 load factor for 12 hours per day
Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

<table>
<thead>
<tr>
<th>Source</th>
<th>ROG</th>
<th>NOX</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM25</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sill</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.41</td>
</tr>
<tr>
<td>Reef</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
</tr>
<tr>
<td>TOTALS (lbs/day, unmitigated)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Operational Settings:

Does not include correction for passby trips
Does not include double counting adjustment for internal trips
Analysis Year: 2011  Temperature (F): 50  Season: Winter
Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Acreage</th>
<th>Trip Rate</th>
<th>Unit Type</th>
<th>No. Units</th>
<th>Total Trips</th>
<th>Total VMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sill</td>
<td>0.03</td>
<td>1000 sq ft</td>
<td>3.20</td>
<td>0.10</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Reef</td>
<td>0.01</td>
<td>1000 sq ft</td>
<td>0.60</td>
<td>0.01</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.11</td>
<td>0.47</td>
<td></td>
</tr>
</tbody>
</table>

Vehicle Fleet Mix

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Percent Type</th>
<th>Non-Catalyst</th>
<th>Catalyst</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Auto</td>
<td>45.2</td>
<td>1.1</td>
<td>98.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Light Truck &lt; 3750 lbs</td>
<td>16.0</td>
<td>1.9</td>
<td>93.1</td>
<td>5.0</td>
</tr>
<tr>
<td>Light Truck 3751-5750 lbs</td>
<td>20.4</td>
<td>1.0</td>
<td>98.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Med Truck 5751-8500 lbs</td>
<td>9.5</td>
<td>0.0</td>
<td>100.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
### Vehicle Fleet Mix

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Percent Type</th>
<th>Non-Catalyst</th>
<th>Catalyst</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lite-Heavy Truck 8501-10,000 lbs</td>
<td>1.5</td>
<td>0.0</td>
<td>73.3</td>
<td>26.7</td>
</tr>
<tr>
<td>Lite-Heavy Truck 10,001-14,000 lbs</td>
<td>0.9</td>
<td>0.0</td>
<td>55.6</td>
<td>44.4</td>
</tr>
<tr>
<td>Med-Heavy Truck 14,001-33,000 lbs</td>
<td>1.3</td>
<td>0.0</td>
<td>23.1</td>
<td>76.9</td>
</tr>
<tr>
<td>Heavy-Heavy Truck 33,001-60,000 lbs</td>
<td>0.5</td>
<td>0.0</td>
<td>20.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Other Bus</td>
<td>0.2</td>
<td>0.0</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Urban Bus</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>3.5</td>
<td>62.9</td>
<td>37.1</td>
<td>0.0</td>
</tr>
<tr>
<td>School Bus</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Motor Home</td>
<td>0.9</td>
<td>0.0</td>
<td>88.9</td>
<td>11.1</td>
</tr>
</tbody>
</table>

### Travel Conditions

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Home-Work</td>
<td>Home-Shop</td>
</tr>
<tr>
<td>Urban Trip Length (miles)</td>
<td>11.8</td>
<td>8.3</td>
</tr>
<tr>
<td>Rural Trip Length (miles)</td>
<td>11.8</td>
<td>8.3</td>
</tr>
<tr>
<td>Trip speeds (mph)</td>
<td>30.0</td>
<td>30.0</td>
</tr>
<tr>
<td>% of Trips - Residential</td>
<td>32.9</td>
<td>18.0</td>
</tr>
<tr>
<td>% of Trips - Commercial (by land use)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sill</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Reef</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
### Summary Report:

#### CONSTRUCTION EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10 Dust</th>
<th>PM10 Exhaust</th>
<th>PM10</th>
<th>PM2.5 Dust</th>
<th>PM2.5 Exhaust</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 TOTALS (tons/year unmitigated)</td>
<td>0.24</td>
<td>2.05</td>
<td>0.91</td>
<td>0.00</td>
<td>0.03</td>
<td>0.10</td>
<td>0.13</td>
<td>0.01</td>
<td>0.09</td>
<td>0.10</td>
<td>207.81</td>
</tr>
</tbody>
</table>

#### AREA SOURCE EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (tons/year, unmitigated)</td>
<td>0.02</td>
<td>0.00</td>
<td>0.28</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>6.06</td>
</tr>
</tbody>
</table>

#### OPERATIONAL (VEHICLE) EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (tons/year, unmitigated)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.08</td>
</tr>
</tbody>
</table>

#### SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>ROG</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
<th>PM2.5</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTALS (tons/year, unmitigated)</td>
<td>0.02</td>
<td>0.00</td>
<td>0.28</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>6.14</td>
</tr>
</tbody>
</table>
Marine Vessel Calculations

Project Name: Parsons Slough

In general, emissions were estimated using the activity and construction or operational information described in the project description. Emission factors for marine vessels are expressed in terms of grams of emissions (of a particular pollutant) per kiloWatt-hour and are based on EPA's Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data formula. KiloWatt-hours are the product of in-use horsepower converted to kiloWatts times hours of use. Project emissions were then calculated by kiloWatt-hours and then converted from grams to pounds.

### Emission Factor Formula

\[ E = a \cdot (FL)^x + b \]

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>x</th>
<th>b</th>
<th>a</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>1.50</td>
<td>0.26</td>
<td>0.01</td>
<td>U.S. EPA, 2000, pg 5-3</td>
</tr>
<tr>
<td>Nox</td>
<td>1.50</td>
<td>10.45</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>SO2</td>
<td>na</td>
<td>ns</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>1.00</td>
<td>0.00</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1.00</td>
<td>648.60</td>
<td>44.10</td>
<td></td>
</tr>
</tbody>
</table>

### Non-Oceangoing Engine Load Factor

<table>
<thead>
<tr>
<th>Source</th>
<th>Load Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. EPA, 2000, pg 5-6</td>
<td>0.80</td>
</tr>
</tbody>
</table>

### For sulfur

\[ E = a(Fuel Sulfur Flow) + b \]

<table>
<thead>
<tr>
<th>Source</th>
<th>Fuel consumption=14.12/load +205.717</th>
<th>Fuel % of fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. EPA, 2000, pg 5-3</td>
<td>0.02</td>
<td>City of Richmond, 2008, pg D-8</td>
</tr>
</tbody>
</table>

### Emission Factors (grams/kiloWatt-hour)

<table>
<thead>
<tr>
<th>Emission Factor</th>
<th>Cruising</th>
<th>Slow Cruising</th>
<th>Maneuvering</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>0.26</td>
<td>0.28</td>
<td>0.32</td>
<td>U.S. EPA, 2000, pg 5-6</td>
</tr>
<tr>
<td>NOx</td>
<td>10.62</td>
<td>10.95</td>
<td>11.85</td>
<td></td>
</tr>
<tr>
<td>SO2</td>
<td>7.95</td>
<td>8.58</td>
<td>9.84</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>1.05</td>
<td>2.09</td>
<td>4.19</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>703.73</td>
<td>758.85</td>
<td>869.10</td>
<td></td>
</tr>
</tbody>
</table>

### Construction Activity Assumptions

<table>
<thead>
<tr>
<th>Horsepower</th>
<th>Kilowatt</th>
<th>Conversion</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Barge Engine Size</td>
<td>460</td>
<td>343.02</td>
<td>1.34</td>
</tr>
<tr>
<td>Push Boat Engine Size</td>
<td>460</td>
<td>343.02</td>
<td>1.34</td>
</tr>
<tr>
<td>Floating barge for crane and pile driver</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Construction Emissions (pounds/day)

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Cruising</th>
<th>Slow Cruising</th>
<th>Maneuvering</th>
<th>Total</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>0.00</td>
<td>0.28</td>
<td>0.24</td>
<td>0.52</td>
<td>0.002</td>
</tr>
<tr>
<td>NOx</td>
<td>0.00</td>
<td>11.01</td>
<td>8.94</td>
<td>19.96</td>
<td></td>
</tr>
<tr>
<td>SO2</td>
<td>0.00</td>
<td>8.63</td>
<td>7.42</td>
<td>16.06</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>0.00</td>
<td>2.11</td>
<td>3.16</td>
<td>5.27</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>0.00</td>
<td>763.55</td>
<td>655.86</td>
<td>1,419.42</td>
<td></td>
</tr>
</tbody>
</table>

### Construction Emissions (tons/year)

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Cruising</th>
<th>Slow Cruising</th>
<th>Maneuvering</th>
<th>Total</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>0.00</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>730,000</td>
</tr>
</tbody>
</table>

### Operational Activity Assumptions

<table>
<thead>
<tr>
<th>Motor Boat Engine Size</th>
<th>Horsepower</th>
<th>Kilowatt</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>14.91</td>
<td>1.34</td>
<td></td>
</tr>
</tbody>
</table>

### Operational Emissions (pounds/day)

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Cruising</th>
<th>Slow Cruising</th>
<th>Maneuvering</th>
<th>Total</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.03</td>
<td>0.002</td>
</tr>
<tr>
<td>NOx</td>
<td>0.35</td>
<td>0.36</td>
<td>0.39</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>SO2</td>
<td>0.26</td>
<td>0.28</td>
<td>0.32</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>0.03</td>
<td>0.07</td>
<td>0.14</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>23.09</td>
<td>24.90</td>
<td>28.52</td>
<td>76.50</td>
<td></td>
</tr>
</tbody>
</table>

### Operational Emissions (tons/year)

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Cruising</th>
<th>Slow Cruising</th>
<th>Maneuvering</th>
<th>Total</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2</td>
<td>0.00003</td>
<td>0.00003</td>
<td>0.00004</td>
<td>0.00010</td>
<td>730,000</td>
</tr>
</tbody>
</table>

**Sources**

Greenhouse Gas (GHG) Emissions Calculations

Project Name: Parsons Slough

Greenhouse Gas (GHG) Emissions from Area Sources and Vehicles

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Annual Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pounds (lbs.)</td>
</tr>
<tr>
<td>URBEMIS2007 Area Emissions</td>
<td>0</td>
</tr>
<tr>
<td>URBEMIS2007 Vehicle Emissions</td>
<td>160</td>
</tr>
<tr>
<td>Total Emissions (area sources + vehicles)</td>
<td>160</td>
</tr>
</tbody>
</table>

Indirect Greenhouse Gas (GHG) Emissions from Project use of Electricity (Power Plant Emissions)

<table>
<thead>
<tr>
<th>Indirect GHG gases</th>
<th>Emission Factor lb/mWh</th>
<th>Project Electricity mWh</th>
<th>GHGs metric tons</th>
<th>CO2 Equivalent Emissions (metric tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (CO2)</td>
<td>521</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nitrous Oxide (N2O)</td>
<td>0.0037</td>
<td>0</td>
<td>0</td>
<td>296</td>
</tr>
<tr>
<td>Methane (CH4)</td>
<td>0.0067</td>
<td>0</td>
<td>0</td>
<td>23</td>
</tr>
</tbody>
</table>

Total Indirect GHG Emissions from Project Electricity Use = 0

Total Annual Greenhouse Gas (GHG) Emission from Project Operations -- All Sources (CO2 equivalent Metric Tons)

<table>
<thead>
<tr>
<th>Source</th>
<th>Emission</th>
<th>CO2 Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Sources</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Vehicles</td>
<td>0.07</td>
<td>100.0%</td>
</tr>
<tr>
<td>Electrical Use</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total =</td>
<td>0.07</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Notes and References:

Total Emissions from Indirect Electricity Use
- Pg. 33 (CCARRP) gives Equations
- Pg. 36 (CCARRP - April 2008 update) gives CO2 output emission rate (lbs/mWh) 878.71 (lbs/mWh)
- Pg. 36 (CCARRP) gives CO2 equivalency factors
- Pg. 36 (CCARRP) gives Methane and Nitrous Oxide electricity emission factors (lbs/mWh) Methane - 0.0067 (lbs/mWh) Nitrous Oxide - 0.0037 (lbs/mWh)
- PG&E Carbon Footprint Calculator gives CO2 output emission rate (lbs/kWh) PG&E 2010 estimate 0.521 lbs/kWh
  
  lbs/metric ton = 2204.62

- Percentage of 25,000: 0.00029%
- Percentage of 169 Million: 0.00000004%

Maximum Year Tons from URBEMIS Metric Tons
- Construction CO2 207.812 189
Appendix B

Biological Resources Report
BIOLOGICAL RESOURCES REPORT
Parsons Slough Project

PREPARED FOR:
California Department of Fish and Game
1234 East Shaw Avenue
Fresno, CA 93710
(559) 243-4005

PREPARED BY:
Vinnedge Environmental Consulting
1800 Grant Street
Berkeley, CA 94703
(510) 665-7885

in association with
Wetlands and Water Resources, Inc.

and

Mike Podlech

August 2010
Table of Contents

Biological Resources ............................................................................................................ 1
  Introduction .......................................................................................................................... 1
  Methods ............................................................................................................................... 1
  Regulatory Context ............................................................................................................ 20
    Federal .................................................................................................................................... 20
    State Regulations ................................................................................................................ 22
  Existing Biological Conditions .......................................................................................... 24
    Natural Communities ......................................................................................................... 24
    Invasive Species ................................................................................................................. 26
    Estuarine Fisheries ............................................................................................................ 26
    Special-Status Species ....................................................................................................... 28
  References ............................................................................................................................ 36
    Personal Communications ................................................................................................ 36
    Literature Cited ................................................................................................................ 36

List of Figures

Figure 1  Project Area ............................................................................................................. 3
Figure 2A  Special-Status Plant Species within the Vicinity .................................................... 5
Figure 2B  Special-Status Wildlife Species within the Vicinity ............................................... 7

List of Tables

Table 1  Special-Status Plant Species with Potential to Occur in the Parsons Slough Project Area, Monterey County ........................................................................................................... 10
Table 2  Special-Status Wildlife Species with Potential to Occur in the Parsons Slough Project Area, Monterey County ........................................................................................................... 13
Table 3  Natural Communities in the Parsons Slough Complex ............................................. 24
Table 4  Fish Species and Relative Abundances in Parsons Slough during the Periods of 1974-1980 and 1995-1996 .................................................................................................................... 28
Biological Resources

This report describes the existing biological resources located within the Parsons Slough project area and the surrounding Elkhorn Slough. Biological resources include wetland, aquatic and terrestrial environments, and special-status plant and animal species.

Introduction

Elkhorn Slough is a seasonal estuary extending inland for seven miles from the midpoint of Monterey Bay in Central California. The estuary contains distinctive habitat types including subtidal channels, tidal creeks, mudflats, salt marshes, and tidal brackish marshes. These habitats provide a rich ecosystem essential for over 340 bird, 550 marine invertebrate, and 102 fish species (Caffrey et al. 2002). Elkhorn Slough is an important nursery for commercial and recreational fish and a premier migratory stopover for birds. Estuaries like Elkhorn Slough are among the most threatened ecosystems in California, and as a result, a disproportionate number of rare, threatened, and endangered species reside in these areas (ESTWPT 2007).

The Parsons Slough Complex is located on the southeast side of Elkhorn Slough and consists of the 254-acre Parsons Slough and the 161-acre South Marsh Area (Figure 1). Human-induced changes in hydrology and land use, along with land subsidence, have significantly increased tidal exchange in Parsons Slough, resulting in increased scour of the slough and reduction in salt marsh habitat. Changes to Parsons Slough hyrology have also affected tidal exchange in the larger Elkhorn Slough system. Within the past 60 years, the proportion of salt marsh habitat to mudflat habitat within Elkhorn Slough has reversed as a result of tidal erosion and inundation of interior marsh areas. Currently, there are approximately 800 acres of salt marsh and tidal creeks within Elkhorn Slough, 1,600 acres of mudflat, and 300 acres of tidal channels. Modeling efforts predict that an additional 550 acres of salt marsh will be lost over the next 50 years if tidal erosion in Elkhorn Slough is not addressed. Without intervention, excessive erosion will continue to widen tidal channels and convert salt marsh to mudflat. This will result in a significant loss of habitat function and a decrease in estuarine biodiversity.

Methods

The results of this report are based on a review of relevant databases and project-specific biological survey reports, as well as periodic site visits. The following databases were searched to determine what natural communities and special-status plant and wildlife species may have the potential to occur within and adjacent to the proposed project area:

- California Natural Diversity Database (CNDDB) for the U.S. Geological Survey (USGS) 7.5-minute Prunedale quadrangle, and the eight surrounding quadrangles (CDFG 2010).
- U.S. Fish and Wildlife Service (USFWS) Threatened and Endangered Species Database (USFWS 2010).
Figures 2A and 2B depict special-status species occurrence data from the CNDDB (CNDDB 2010). Special-status species are defined as those species that meet one or more of the following criteria:

- Species that are listed or proposed for listing as threatened or endangered under the Federal Endangered Species Act (ESA) (50 Code of Federal Regulations [CFR] 17.12 for listed plants, 50 CFR 17.11 for listed animals, and various notices in the Federal Register [FR] for proposed species);

- Species that are candidates for possible future listing as threatened or endangered under FESA (64 FR 57534, October 25, 1999);

- Species that are listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (CESA) (14 California Code of Regulations [CCR] 670.5);

- Plants listed as rare under the California Native Plant Protection Act of 1977 (California Fish and Game Code, Section 1900 et seq.);

- Plants considered by the California Native Plant Society (CNPS) to be “rare, threatened, or endangered in California”;

- Species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);

- Animals fully protected in California (California Fish and Game Code, Section 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]); and

- Nesting raptors protected in California (California Fish and Game Code, Section 3503.5)

A complete list of all common and special-status species known from and with potential to occur in the Elkhorn Slough watershed is provided in Appendix 5 - Habitats and Species in the Elkhorn Slough National Estuarine Research Reserve Final Management Plan 2007-2011 (ESNERR 2006).
Tables 1 and 2 provide a summary of the status, habitat requirements, and potential for occurrence for each of the special-status species with potential to occur in the project area. These lists are a compilation of those species obtained from the CNDDB search results (Figures 2A and 2B), the USFWS species list for Monterey County, and species lists provided in the Elkhorn Slough National Estuarine Research Reserve Final Management Plan 2007-2011 (CNDDB 2010, USFWS 2010, ESNERR 2006). In evaluating the occurrence potential of special-status species in the project area, biologists considered relevant literature, knowledge of regional biota, existing data from regional experts, and observations made during the field investigations as analysis criteria. Using these criteria, the potential for each species to occur in the project was evaluated, and each species was placed into one of four categories as defined below:

- **None** indicates that the area contains a complete lack of suitable habitat, the local range for the species is restricted, and/or the species is extirpated in this region.

- **Not Expected** indicates situations where suitable habitat or key habitat elements may be present but may be of poor quality or isolated from the nearest extant occurrences. Habitat suitability refers to factors such as elevation, soil chemistry and type, vegetation communities, microhabitats, and degraded/significantly altered habitats.

- **Possible** indicates the presence of suitable habitat or key habitat elements that potentially support the species.

- **Present** indicates the target species was either observed directly or its presence was confirmed by diagnostic signs (i.e. tracks, scat, burrows, carcasses, castings, prey remains, etc.) during field investigations.
Table 1  Special-Status Plant Species with Potential to Occur in the Parsons Slough Project Area, Monterey County

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Listing Status (Federal/State)</th>
<th>General Habitat</th>
<th>Potential for Occurrence in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ben Lomond spineflower</td>
<td>Chorizanthe pungens var. hartwegiana</td>
<td>FE / -</td>
<td>Maritime Ponderosa Pine Sandhills</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Monterey Spineflower</td>
<td>Chorizanthe pungens var. pungens</td>
<td>FT / -</td>
<td>Sandy Sites in: Maritime Chaparral Cismontane Woodland Coastal Dunes Coastal Scrub Valley and Foothill Grassland</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Monterey Spineflower</td>
<td>Chorizanthe robusta var. robusta</td>
<td>FE / -</td>
<td>Sandy or Gravelly Sites in: Maritime Chaparral Openings in Cismontane Woodland Coastal Dunes Coastal Scrub</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Seaside Bird’s-beak</td>
<td>Cordylanthus rigidus ssp. littoralis</td>
<td>- / CE</td>
<td>Sandy, Often Disturbed Sites in: Closed-cone Coniferous Forest Maritime Chaparral Cismontane Woodland Coastal Dunes Coastal Scrub</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Ydon’s Wallflower</td>
<td>Erysimum menziesii ssp. ydonii</td>
<td>FE / CE</td>
<td>Coastal Dunes</td>
<td>None: lacks suitable vegetation associations or substrate present.</td>
</tr>
<tr>
<td>Monterey Gilia</td>
<td>Gilia tenuiflora ssp. arenaria</td>
<td>FE / CT</td>
<td>Sandy Sites in openings of: Maritime Chaparral Cismontane Woodland Coastal Dunes Coastal scrub</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Santa Cruz Tarplant</td>
<td>Holocarpha macradenia</td>
<td>FT / CE</td>
<td>Often on Clay Sites in: Coastal Prairie Coastal Scrub Valley and Foothill Grassland</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Contra Costa Goldfields</td>
<td>Lasthenia conjugens</td>
<td>FE / -</td>
<td>Occurs on Mesic Sites in: Cismontane Woodland Alkaline Playas Valley and Foothill Grassland Vernal Pools</td>
<td>None: lacks suitable vegetation associations and vernal hydrology.</td>
</tr>
<tr>
<td>Tidestrom’s lupine</td>
<td>Lupinus tidestromii</td>
<td>FE / CE</td>
<td>Coastal Dunes</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
</tr>
<tr>
<td>Common Name Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
<td>Potential for Occurrence in Project Area</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------</td>
<td>-----------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>White-rayed Pentachaeta</td>
<td>FE / CE</td>
<td>Often on Serpentine Sites in: Cismontane Woodland Valley and Foothill Grassland</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
<td></td>
</tr>
<tr>
<td>Yadon's Piperia</td>
<td>FT / -</td>
<td>Occurs on Sandy Sites in: Coastal Bluff Scrub Closed-cone Coniferous Forest Maritime Chaparral</td>
<td>None: lacks suitable vegetation associations and substrate.</td>
<td></td>
</tr>
<tr>
<td>San Francisco popcorn-flower</td>
<td>- / CT</td>
<td>Coastal Prairie Valley and Foothill Grassland</td>
<td>None. Not documented from Monterey County. Project area lacks suitable vegetation associations.</td>
<td></td>
</tr>
</tbody>
</table>

### California Native Plant Society Listed and Locally Rare Species

<table>
<thead>
<tr>
<th>Common Name Scientific Name</th>
<th>Listing Status (Federal/State)</th>
<th>General Habitat</th>
<th>Potential for Occurrence in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hooker’s manzanita Arctostaphylos hookeri ssp. hookeri</td>
<td>CNPS 1B.2</td>
<td>Chaparral</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Pajaro manzanita Arctostaphylos pajaroenis</td>
<td>CNPS 1B.1</td>
<td>Chaparral</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Monterey Indian plant Castilleja latifolia</td>
<td>CNPS 4.3</td>
<td>Coastal dune</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Monterey ceanothus Ceanothus cuneatus var. rigidus</td>
<td>CNPS 4.2</td>
<td>Chaparral</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Congdon’s tarplant Centromadia parryi ssp. Congdonii</td>
<td>CNPS 1B.2</td>
<td>Grassland</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Eastwood’s goldenbush Ericameria fasciculata</td>
<td>CNPS 1B.1</td>
<td>Maritime chaparral</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Fragrant fritillary Fritillaria liliacea</td>
<td>CNPS 1B.2</td>
<td>Cismontane woodland, Coastal prairie, coastal scrub, valley and foothill grassland near the coast, on clay or serpentine soils</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Small-leaved lomatium Lomatium parvifolium</td>
<td>CNPS 4.2</td>
<td>Chaparral, coastal scrub, and riparian woodland</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Gairdner’s Yampah Perideridia gairdneri ssp. gairdneri</td>
<td>CNPS 4.2</td>
<td>Grassland and chaparral</td>
<td>None: lacks suitable vegetation associations.</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>--------------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Artist’s popcorn flower</td>
<td><em>Plagiobothrys chorisianus var.</em> chorisianus</td>
<td>CNPS 1B.2</td>
<td>Occurs in mesic valley and foothill grassland and possibly in coastal salt marsh and swamps</td>
</tr>
<tr>
<td>Pine rose</td>
<td><em>Rosa pinetorum</em></td>
<td>CNPS 1B.2</td>
<td>Closed cone coniferous forest</td>
</tr>
<tr>
<td>Santa Cruz clover</td>
<td><em>Trifolium buckwestiorum</em></td>
<td>CNPS 1B.1</td>
<td>Occurs in broadleaved upland forest, cismontane woodland, and margins of coastal prairies</td>
</tr>
<tr>
<td>Water sack clover</td>
<td><em>Trifolium depauperatum var. hydrophilum</em></td>
<td>CNPS 1B.2</td>
<td>Marshes and swamps, and valley and foothill grassland, and vernal pools. Occurs on mesic and alkaline sites.</td>
</tr>
</tbody>
</table>

Source: CNDDB 2010; USFWS 2010; ESNERR 2006

**STATUS CODES:**

**FEDERAL**

FE = Listed as Endangered by the USFWS  
FT = Listed as Threatened by the USFWS  
FC = Candidate for Federal listing

**STATE**

CE = Listed as Endangered by the State of California  
CT = Listed as Threatened by the State of California

**CALIFORNIA NATIVE PLANT SOCIETY (CNPS STATUS)**

1A – Plants presumed extinct in California  
1B – Plants rare, threatened, or endangered in California and elsewhere  
2 – Plants rare, threatened, or endangered in California, but more common elsewhere  
3 – Plants about which we need more information – a review list  
4 – Plants of limited distribution – a watch list

**CNPS THREAT CODE EXTENSIONS:**

.1 – Seriously endangered in California.  
.2 – Fairly endangered in California.  
.3 – Not very endangered in California.
Table 2  Special-Status Wildlife Species with Potential to Occur in the Parsons Slough Project Area, Monterey County

<table>
<thead>
<tr>
<th>Common Name Scientific Name</th>
<th>Listing Status (Federal/State)</th>
<th>General Habitat</th>
<th>Potential for Occurrence in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FISHES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central California coast coho salmon  <em>Oncorhynchus kisutch</em></td>
<td>FE / CE</td>
<td>Anadromous. Spawns in freshwater in areas with suitable spawning gravels. Juveniles require cool, clean water, cover, and sufficient dissolved oxygen.</td>
<td>Not expected. Known to occur in Monterey Bay, but have not been observed in Elkhorn Slough. Based on discussions with NMFS staff, it was determined that although the species may at times stray into the project area, their occurrences are deemed sufficiently infrequent that the proposed project would be unlikely to impact the species.</td>
</tr>
<tr>
<td>Central California coast steelhead  <em>Oncorhynchus mykiss</em></td>
<td>FT / CSC</td>
<td>Anadromous. Spawns in freshwater in areas with suitable spawning gravels. Juveniles require cool, clean water, cover, and sufficient dissolved oxygen.</td>
<td>Possible. Steelhead of unknown run/ESU have occasionally been observed in Elkhorn Slough, but based on discussions with NMFS staff, it was determined that although the species may at times stray into the project area, their occurrences are deemed sufficiently infrequent that the proposed project would be unlikely to impact the species.</td>
</tr>
<tr>
<td>Central Valley Spring-run Chinook Salmon  <em>Oncorhynchus tshawytscha</em></td>
<td>FT / CT</td>
<td>Anadromous. Inhabit major rivers in central California. Migrate into headwaters in February through July and hold in pools until spawning period. Spawn in central valley.</td>
<td>Possible. Chinook salmon of unknown run/ESU have occasionally been observed in Elkhorn Slough, but based on discussions with NMFS staff, it was determined that although the species may at times stray into the project area, their occurrences are deemed sufficiently infrequent that the proposed project would be unlikely to impact the species.</td>
</tr>
<tr>
<td>Sacramento River Winter-run Chinook Salmon  <em>Oncorhynchus tshawytscha</em></td>
<td>FE / CE</td>
<td>Anadromous. Inhabit major rivers in central California. Spawn in the Sacramento River watershed.</td>
<td>Possible. Chinook salmon of unknown run/ESU have occasionally been observed in Elkhorn Slough, but based on discussions with NMFS staff, it was determined that although the species may at times stray into the project area, their occurrences are deemed sufficiently infrequent that the proposed action would be unlikely to impact the species.</td>
</tr>
<tr>
<td>Common Name Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
<td>Potential for Occurrence in Project Area</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>-----------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Central Valley Fall/Late Fall-run Chinook Salmon <em>Oncorhynchus tshawytscha</em></td>
<td>- / CSC</td>
<td>Anadromous. Inhabit major rivers in central California. Spawn in central valley.</td>
<td>Possible. Chinook salmon of unknown run/ESU have occasionally been observed in Elkhorn Slough, but based on discussions with NMFS staff, it was determined that although the species may at times stray into the project area, their occurrences are deemed sufficiently infrequent that the proposed action would be unlikely to impact the species.</td>
</tr>
<tr>
<td>North American green sturgeon, Southern Distinct Population Segment (DPS) <em>Acipenser medirostris</em></td>
<td>FT / -</td>
<td>Within the marine environment, the Southern DPS occupies coastal bays and estuaries from Monterey Bay, California, to Puget Sound, Washington.</td>
<td>Possible. There is very little data on green sturgeon presence in, and use of, Elkhorn Slough. Based on available data and informal discussions with NMFS staff, it was determined that while green sturgeon may at times stray into Elkhorn Slough, their occurrences are deemed sufficiently infrequent that the proposed action would be unlikely to affect the species.</td>
</tr>
<tr>
<td>Tidewater goby <em>Eucyclogobius newberryi</em></td>
<td>FE / -</td>
<td>Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water &amp; high oxygen levels.</td>
<td>Not expected. Known to occur in Bennett and Moro Cojo sloughs within the Elkhorn Slough Complex, but the species’ dependence on low tidal flows is expected to exclude it from the tidally influenced project area.</td>
</tr>
<tr>
<td>Ohlone tiger beetle <em>Cicindela ohlone</em></td>
<td>FE / -</td>
<td>Found only on, and adjacent to, coastal prairie terrace habitat marked by poorly drained clay soils. Specific clay soils that provide moisture, composition, and temperature conditions necessary for egg-laying and larval development.</td>
<td>None. No suitable habitat for this species within or adjacent to the project area.</td>
</tr>
<tr>
<td>Globose dune beetle <em>Coelus globosus</em></td>
<td>- / -</td>
<td>Burrows beneath the sand surface of foredunes and sand hummocks, and is most commonly found beneath dune vegetation.</td>
<td>Not Expected. Known from Sunset State Beach and Salinas River State Beach within 5 miles of the project area. No suitable dune habitat in project area.</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Monarch butterfly</td>
<td>Danaus plexippus</td>
<td>- / -</td>
<td>Winter roost sites extend along the coast from northern Mendocino to Baja California, Mexico. Host plant is milkweed (Asclepius spp.). Fall migration occurs from August through October. Overwintering roosts in California commonly occur on Eucalyptus tree.</td>
</tr>
<tr>
<td>California brackish water snail</td>
<td>Tryonia imitator</td>
<td>- / -</td>
<td>Coastal lagoons, estuaries and salt marshes in permanently submerged areas in a wide range of sediment types and salinities.</td>
</tr>
<tr>
<td>Zayante band-winged grasshopper</td>
<td>Trimerotropis infantilis</td>
<td>FE / -</td>
<td>Open habitat characterized by a sparse canopy of ponderosa pines surrounded by a diverse assemblage of subshrubs and herbaceous plants.</td>
</tr>
<tr>
<td>Olympia oyster</td>
<td>Ostrea lurida</td>
<td>- / -</td>
<td>The Olympia oyster survives in broad range of habitats but most abundant in estuaries, small rivers, and streams; however it is limited almost entirely to estuaries throughout its range from Baja California to Alaska.</td>
</tr>
</tbody>
</table>

### AMPHIBIANS

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Listing Status (Federal/State)</th>
<th>General Habitat</th>
<th>Potential for Occurrence in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Tiger Salamander</td>
<td>Ambystoma californiense</td>
<td>FT / PT</td>
<td>Freshwater ponds and wetlands, brackish and salt marshes, annual grasslands and grassy understory of valley-foothill hardwood forests. Breed in underground refuges, usually ground squirrel burrows, and vernal pools.</td>
<td>None. No suitable freshwater habitat for this species occurs within the project area.</td>
</tr>
<tr>
<td>Santa Cruz Long-Toed Salamander</td>
<td>Ambystoma macrodactylum croceum</td>
<td>FE / CE, FP</td>
<td>Wet meadows, coastal woodlands and chaparral near ponds and freshwater marshes. Breeds in shallow, temporary freshwater ponds.</td>
<td>None. No suitable freshwater habitat for this species occurs within the project area.</td>
</tr>
<tr>
<td>California red-legged frog</td>
<td>Rana draytonii</td>
<td>FT / CSC</td>
<td>Lowlands or foothills in or near sources of water with shrubby or emergent riparian vegetation.</td>
<td>None. No suitable freshwater habitat for this species occurs within the project area.</td>
</tr>
</tbody>
</table>

### REPTILES

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Listing Status (Federal/State)</th>
<th>General Habitat</th>
<th>Potential for Occurrence in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silvery legless lizard</td>
<td>Anniella pulchra pulchra</td>
<td>- / CSC</td>
<td>Inhabit areas with sandy or loose loamy soils such as under sparse vegetation of beaches, chaparral, or pine-oak woodland; or near sycamores, cottonwoods, or oaks that grow on stream terraces.</td>
<td>None. No suitable sand dune habitat occurs within the project area.</td>
</tr>
<tr>
<td>Common Name Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
<td>Potential for Occurrence in Project Area</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Black legless lizard</td>
<td>- / CSC, FP</td>
<td>Sand dunes and moist sandy soils with bush lupine and mock heather as dominant plants</td>
<td>None. No suitable sand dune habitat occurs within the project area.</td>
<td></td>
</tr>
<tr>
<td><em>Anniella pulchra nigra</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western pond turtle</td>
<td>- / CSC</td>
<td>A moderate sized freshwater turtle that inhabits permanent or nearly permanent bodies of water and low gradient slow moving streams below 6,000 feet elevation.</td>
<td>None. No suitable freshwater habitat occurs within the project area.</td>
<td></td>
</tr>
<tr>
<td><em>Emys (Clemmys) marmorata</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double-crested Cormorant</td>
<td>- / WL</td>
<td>Aquatic habitats such as lakes, artificial impoundments, slow-moving rivers, lagoons, estuaries, swamps, seacoasts and coastal cliffs.</td>
<td>Present. Suitable nesting habitat in pines and eucalyptus trees adjacent to the project area.</td>
<td></td>
</tr>
<tr>
<td><em>Phalocrocorax auritus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Gull</td>
<td>- / WL</td>
<td>Habitat generalist in non-breeding season. Breeds in lakes, farms, and marshes. Nests on gravel islands in large rivers or lakes.</td>
<td>Present. Suitable habitat present in and adjacent to project area.</td>
<td></td>
</tr>
<tr>
<td><em>Larus californicus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-billed Curlew</td>
<td>- / WL</td>
<td>Coastal mudflats and marshes. Breeds in dry grasslands and shrub savannah.</td>
<td>Present. Suitable foraging habitat present in the project area.</td>
<td></td>
</tr>
<tr>
<td><em>Numenius americanus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Brown Pelican</td>
<td>DL / FP</td>
<td>Pelagic. Beach and nearshore waters. Roosts during daytime on area beaches.</td>
<td>Present. Roosts in project study area. Roosts in open water habitat on South Marsh – just north of project area. Species has been delisted from ESA due to recovery.</td>
<td></td>
</tr>
<tr>
<td><em>Pelecanus occidentalis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Least Tern</td>
<td>FT / CSC</td>
<td>Inhabit coastal beaches above the normal high-tide limit in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent.</td>
<td>Not Expected. Present in former salt ponds west of project area near Moss Landing. Potential foraging habitat present near Kirby Park staging area. Project activities would not impact breeding habitat for plover.</td>
<td></td>
</tr>
<tr>
<td><em>Sterna antillarum</em></td>
<td>FE / CE,FP</td>
<td>Nearshore beaches with bare or sparse vegetation, including sandy beaches, alkali flats, paved areas or land fills. Salt marshes.</td>
<td>Not Expected. Observed in Elkhorn slough during migration. Does not nest in project area.</td>
<td></td>
</tr>
<tr>
<td>California Clapper Rail</td>
<td>FE / CE, FP</td>
<td>Saltwater and brackish marshes traversed with tidal sloughs. Associated with abundant growths of pickleweed.</td>
<td>None. Last recorded in the area in 1972. Restricted to salt marsh habitats in San Francisco Bay.</td>
<td></td>
</tr>
<tr>
<td><em>Rallus longirostris</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California Black Rail</td>
<td>- / CT, FP</td>
<td>Salt and freshwater marshes, grassy wet meadows.</td>
<td>None. No suitable marsh habitat in project area. No known from within 5 miles of project area (CNDDB 2010).</td>
<td></td>
</tr>
<tr>
<td><em>Laterallus jamaicensis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
<td>Potential for Occurrence in Project Area</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>White-tailed Kite</td>
<td>Elanus leucurus</td>
<td>- / FP</td>
<td>Inhabits grasslands, agriculture fields, oak woodlands, savannah and riparian habitats in rural and urban areas. Feeds primarily on California voles. Year-round resident of Central and Coastal California. Breeding begins in February; sometimes double-brooded.</td>
<td>Possible. Known from study area – near South Marsh (CNDDB 2010). No suitable nesting or foraging habitat in project area. Suitable nesting habitat north of Parsons Slough in eucalyptus trees east of North Marsh.</td>
</tr>
<tr>
<td>Northern Harrier</td>
<td>Circus cyaneus</td>
<td>- / CSC</td>
<td>Inhabits both freshwater and saltwater marshes and adjacent upland grasslands. Nests on the ground in tall grasses in grasslands and meadows. Breeding begins in March; single-brooded.</td>
<td>Possible. Suitable nesting and foraging habitat in upland habitat adjacent to project area. No nesting habitat in project area.</td>
</tr>
<tr>
<td>Golden Eagle</td>
<td>Aquila chrysaetos</td>
<td>EPA / FP</td>
<td>A large diurnal raptor that nests on cliffs and in large trees in open areas. Forages in open terrain including grasslands, deserts, savannahs and early successional stages of forest and shrub habitats.</td>
<td>Not Expected. Suitable foraging habitat in vicinity of project area. No suitable nesting habitat.</td>
</tr>
<tr>
<td>Osprey</td>
<td>Pandion haliaetus</td>
<td>- / 3503.S</td>
<td>Inhabits rivers, lakes and coastal habitats. Nest in tall trees near water bodies with sufficient prey. Range is almost cosmopolitan throughout California.</td>
<td>Possible. Suitable foraging habitat in project area. Suitable nesting habitat north of Parsons Slough in eucalyptus trees east of North Marsh.</td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>Falco peregrinus anatum</td>
<td>- / CE, FP</td>
<td>Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodlands; open grasslands, meadows or marshes.</td>
<td>Not Expected. Migrant only. Nesting not documented from Elkhorn Slough.</td>
</tr>
<tr>
<td>Short-eared Owl</td>
<td>Asio flammeus</td>
<td>- / CSC</td>
<td>Inhabits open grasslands, prairies, marshes and agricultural fields with sufficient vegetative cover and abundant small mammal prey. Nests on the ground in a shallow depression.</td>
<td>Possible. Suitable nesting and foraging habitat adjacent to project area. Known from vicinity (CNDDB 2010).</td>
</tr>
<tr>
<td>Western Burrowing Owl</td>
<td>Athene cunicularia hypugae</td>
<td>- / CSC</td>
<td>Valley bottoms and foothills with low vegetation and fossorial mammal activity.</td>
<td>None. No suitable upland habitat/burrows in project area. Known from within 5 miles of project area (CNDDB 2010).</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
<td>Potential for Occurrence in Project Area</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>--------------------------------</td>
<td>-----------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Bank Swallow</td>
<td>Riparia riparia</td>
<td>- / CT</td>
<td>Riparian and other lowland habitats. Requires vertical banks/cliffs with fine/ sandy soils near streams, rivers, lakes, or ocean for breeding.</td>
<td>Not Expected. No suitable bank habitat present in study area. Known from approximately 2 miles northwest of project area (CNDDB 2010).</td>
</tr>
<tr>
<td>Black Swift</td>
<td>Cypseloides niger</td>
<td>- / CSC</td>
<td>Nests on canyon walls near water and sheltered by overhanging rock or moss, preferably near waterfalls or on sea cliffs.</td>
<td>Not Expected. No suitable nesting habitat in project area. No known occurrences from vicinity.</td>
</tr>
<tr>
<td>Tricolored Blackbird</td>
<td>Agelaius tricolor</td>
<td>- / CSC</td>
<td>Highly colonial species, most numerous in central valley. Largely endemic to California. Nest in emergent vegetation within aquatic and riparian habitats.</td>
<td>Not Expected. Kirby Park vicinity contains suitable emergent vegetation (blackberry) habitat, but species is not known from this location. Documented from within 5 miles of area (CNDDB 2010).</td>
</tr>
</tbody>
</table>

**MAMMALS**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Listing Status (Federal/State)</th>
<th>General Habitat</th>
<th>Potential for Occurrence in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Francisco dusky-footed woodrat</td>
<td>Neotoma fuscipes annectens</td>
<td>- / CSC</td>
<td>Deciduous woodlands, scrubs, and thickets.</td>
<td>None. No suitable habitat present in project area.</td>
</tr>
<tr>
<td>Townsend’s big-eared bat</td>
<td>Corynorhinus (=Plecotus) townsendii townsendii</td>
<td>- / CSC</td>
<td>Inhabits caves and mines, but may also use bridges, buildings, rock crevices and tree hollows in coastal lowlands, cultivated valleys and nearby hills characterized by mixed vegetation throughout California below 3,300 meters.</td>
<td>Possible. Marginal foraging and roosting habitat present in project area near UPRR bridge.</td>
</tr>
<tr>
<td>Hoary bat</td>
<td>Lasiurus cinereus</td>
<td>- / -</td>
<td>Ubiquitous throughout California. A solitary foliage rooster that prefers evergreens, but will use deciduous trees in forested habitats, particularly in edge habitat. May forage in small to large groups. Feeds primarily on moths, but will eat a variety of other insects. Migrates great distances.</td>
<td>Not Expected. Suitable foraging habitat present in study area. Known from within 5 miles of project area (CNDDB 2010).</td>
</tr>
<tr>
<td>Salinas harvest mouse</td>
<td>Reithrodontomys megalotis distichilis</td>
<td>- / -</td>
<td>Fresh and brackish water wetlands and adjacent uplands.</td>
<td>Possible. Known from ESNERR and from within 1 mile of project area (CNDDB 2010).</td>
</tr>
<tr>
<td>Monterey / Salinas Ornate Shrew</td>
<td>Sorex ornatus salarius</td>
<td>- / CSC</td>
<td>Ornate shrews are typically found in brackish water marshes; along streams; in brushy areas of valleys and foothills; and in forests. They especially favor low, dense vegetation that forms a cover for worms and insects.</td>
<td>Not Expected. Marginal vegetation habitat in the Kirby Park area. Sill site does not contain suitable habitat for this species.</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Listing Status (Federal/State)</td>
<td>General Habitat</td>
<td>Potential for Occurrence in Project Area</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Southern sea otter</td>
<td><em>Enhydra lutris nereis</em></td>
<td>FT, MMPA / FP</td>
<td>An aquatic mustelid that inhabits shallow nearshore waters with rocky or sandy bottoms that support large populations of benthic invertebrate prey.</td>
<td>Present. Approximately 17 to 28 individuals observed in and adjacent to Parsons Slough.</td>
</tr>
<tr>
<td>Harbor seal</td>
<td><em>Phoca vitulina</em></td>
<td>MMPA / -</td>
<td>Marine mammal found in temperate coastal habitats. Uses rocks, reefs, beaches, and drifting glacial ice as haul-out and pupping sites. Found near shore in estuaries or protected waters, but may range far out to sea in deep pelagic waters or up freshwater rivers and into lakes.</td>
<td>Present. Harbor seals use mudflats in the Parsons Slough Complex and channel for resting (haul-out) during low tide.</td>
</tr>
<tr>
<td>American badger</td>
<td><em>Taxidea taxus</em></td>
<td>- / CSC</td>
<td>A large mustelid that inhabits open areas with friable soils within woodland, grassland, savannah and desert habitats. A fossorial mammal that preys predominately on ground squirrels and pocket gophers.</td>
<td>None. No suitable upland habitat for this species in the project area. Known from within 5 miles of the project area (CNDDB 2010).</td>
</tr>
</tbody>
</table>

Source: CNDDB 2010, USFWS 2010

**STATUS CODES:**

**FEDERAL**

FE = Listed as Endangered

FT = Listed as Threatened

DL = Delisted

MMPA = Marine Mammal Protection Act

EPA = Bald Eagle and Golden Eagle Protection Act

**STATE**

CE = Listed as Endangered by the State of California

CT = Listed as Threatened by the State of California

PT = Proposed for Listed as Threatened

CSC = California species of special concern

FP = California Fish and Game Code §4700 (fully protected species)

WL = California Fish and Game Watch List

3503.5 = California Fish and Game Code §3503.5 (no harm to raptor nests or eggs)
Regulatory Context

This section provides an overview of the laws and regulations that apply to the biological resources within the Parsons Slough Project study area.

Federal

Clean Water Act

The Clean Water Act (CWA) is the primary Federal law protecting the quality of the nation’s surface waters, including lakes, rivers, and coastal wetlands. Through the CWA, the U.S. Environmental Protection Agency (EPA) sets national water quality standards and effluent limitations, and establishes permit review mechanisms to enforce them.

Most of the CWA’s provisions are at least indirectly relevant to the management and protection of biological resources because of the link between water quality and ecosystem health. The portions of the CWA that are most directly relevant to biological resources management are contained in CWA Sections 404 and 401, which regulate the discharge of dredged and fill materials into “waters of the United States,” and verify that discharges aren’t violating State water quality standards, respectively.

Compliance with CWA Section 404 requires compliance with several other environmental laws and regulations, including the National Environmental Policy Act (NEPA), the Federal Endangered Species Act (ESA), the Federal Coastal Zone Management Act (CZMA), and the National Historic Preservation Act (NHPA). In addition, the U.S. Army Corps of Engineers (USACE), the Federal agency tasked with the day-to-day implementation of Section 404, cannot issue or verify any permit until a water quality certification, or waiver of certification, has been issued by the appropriate Regional Water Quality Control Board (RWQCB) pursuant to CWA Section 401.

Federal Endangered Species Act

The USFWS and the National Marine Fisheries Service (NMFS) have jurisdiction over species listed as threatened or endangered under the ESA. Section 9 of the ESA protects listed species from take, which is broadly defined as actions that “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.” For any project involving a Federal agency in which a listed species could be affected, the Federal agency must consult with the USFWS and/or NMFS in accordance with Section 7 of the ESA. USFWS and/or NMFS may issue a biological opinion(s), with an incidental take statement, if they determine that the project would not jeopardize the continued existence of the listed species.

In compliance with the ESA, the National Oceanic and Atmospheric Administration (NOAA) (the Federal funding agency for the proposed project) will coordinate and consult with NMFS and USFWS on potential project effects on Federally threatened and endangered plants, animals and fish. It is anticipated that the consultation will focus on effects to one Federally-listed species: the southern sea otter (Enhydra lutris nereis; Federally listed as threatened). Consultation between NOAA and
USFWS/NMFS will be initiated by submittal of a Biological Assessment that describes potential program effects on Federally-listed species.

**Marine Mammal Protection Act**

The Marine Mammal Protection Act (MMPA) of 1972, as amended, (16 U.S.C. 1361 et seq.) provides a general prohibition on activities that may result in the take of marine mammals, with limited exceptions for scientific research, commercial fisheries, subsistence harvest by Alaska Natives, activities that take marine mammals incidentally but that have a negligible impact on their populations, and military activities deemed essential for national defense. Similar to the ESA, implementation responsibility under the MMPA is divided between USFWS and NMFS. In addition, a third Federal agency, the Marine Mammal Commission, reviews existing policies and make recommendations to the USFWS and NMFS on ways to better implement the MMPA. Under the MMPA, Federal agencies are required to manage marine mammals to their optimum sustainable population (OSP) level.

USFWS is responsible for ensuring the protection of sea otters and marine otters, walruses, polar bears, three species of manatees, and dugongs. NMFS is responsible for conserving and managing populations of pinnipeds, including seals and sea lions and cetaceans, such as whales and dolphins. Both southern sea otter and harbor seal (Phoca vitulina) are found in the project area year-round. Because of its ESA status, the southern sea otter is considered by default to be a “strategic stock” and “depleted” under the MMPA. Harbor seals are not considered a "strategic" stock under the MMPA because the population appears to be stabilizing at what may be their carrying capacity, and the fishery morality is declining (NMML 2005).

Proposed project activities may require an Incidental Harassment Authorization (IHA) permit for harbor seal under the MMPA. Project impacts on southern sea otter will be addressed by USFWS during their ESA consultation with NOAA for the proposed project.

**Magnuson-Stevens Fishery Conservation and Management Act**

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires that Federal agencies consult with NMFS on activities that may directly or indirectly affect designated Essential Fish Habitat (EFH). The Magnuson-Stevens Act also requires all fishery management councils to amend their Fisheries Management Plans (FMP) to describe and identify EFH for each managed fishery. Under section 305(b)(4) of the Magnuson-Stevens Act, NMFS is required to provide EFH conservation and enhancement recommendations to Federal and State agencies for actions that adversely affect EFH. Although the concept of EFH is similar to that of critical habitat under the ESA, measures recommended to protect EFH by NMFS are advisory, not proscriptive.

NMFS strongly encourages efforts to streamline EFH consultation with other Federal consultation processes. EFH consultation can be consolidated, where appropriate, with interagency consultation, coordination and environmental review procedures required by other statutes, including ESA consultations.
The proposed project area is located within areas identified as EFH for various life stages of marine and estuarine fish species managed under the Pacific Coast Salmon FMP, Coastal Pelagic Species FMP, and Pacific Coast Groundfish FMP. In addition, the project area is located within an area designated as a Habitat Area of Particular Concern (HAPC) for Pacific Coast groundfish species. HAPCs are subsets of EFH that play a particularly important ecological role in the fish life cycle or that are especially sensitive, rare, or vulnerable. HAPCs are identified differently from EFH. EFH is identified for each species and life stage; in contrast, HAPCs are identified on the basis of habitat level considerations: 1) the importance of the ecological function provided by the habitat; 2) the extent to which the habitat is sensitive to human-induced environmental degradation; 3) whether and to what extent development activities are or will be stressing the habitat; and, 4) the rarity of the habitat type. Estuaries, seagrass beds, canopy kelp, rocky reefs, and other “areas of interest” (e.g., seamounts, offshore banks, canyons) are designated HAPC for managed groundfish species (PFMC 2006). Elkhorn Slough is an estuary and is therefore considered an HAPC. In addition, patches of eelgrass (Zostera marina) occurring within the main channel of Elkhorn Slough constitute seagrass HAPC.

Information to support consultation with NMFS on potential project impacts to EFH will be included in the project Biological Assessment submitted by NOAA to that agency.

**Migratory Bird Treaty Act**

The Migratory Bird Treaty Act (MBTA) (16 USC 703) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and the former Soviet Union and authorizes the U.S. Secretary of the Interior, through the USFWS, to protect and regulate the taking of migratory birds. It establishes seasons and bag limits for hunted species and protects migratory birds, their occupied nests, and their eggs (16 USC 703, 50 CFR 21, 50 CFR 10). Most actions that result in taking or in permanent or temporary possession of a protected species constitute violations of the MBTA. Examples of permitted actions that do not violate the MBTA include the possession of a hunting license to pursue specific gamebirds, legitimate research activities, display in zoological gardens, bird-banding, and other similar activities. USFWS is responsible for overseeing compliance with the MBTA. Migratory birds may nest on the ground or in vegetation within the project vicinity.

**State Regulations**

**Porter-Cologne Water Quality Control Act**

The Porter-Cologne Water Quality Control Act (Porter-Cologne) established the State Water Resources Control Board (SWRCB) and divided the State into nine regional basins, each of is under the jurisdiction of a different RWQCB. Porter-Cologne authorizes the SWRCB to draft State policies regarding water quality. Additionally, Porter-Cologne requires the SWRCB to issue Waste Discharge Requirements (WDR) for discharges into state-controlled waters. Porter-Cologne also requires the SWRCB or the RWQCB to adopt water quality control plans, or Basin Plans, for the protection of water quality. A Basin Plan must identify the beneficial uses of water to be protected, establish water quality objectives for the reasonable protection of the beneficial uses, and establish a program of implementation for achieving the water quality objectives.
California Endangered Species Act

The California Endangered Species Act (CESA), which is administered by the California Department of Fish and Game (CDFG), protects wildlife and plants listed as threatened and endangered by the California Fish and Game Commission. CESA prohibits all persons from taking species that are state-listed as threatened or endangered except under certain circumstances. The CESA defines “take” as any action or attempt to “hunt, pursue, catch, capture, or kill” a listed species.

Section 2081 of the CESA provides a means by which agencies or individuals may obtain authorization for incidental take of state-listed species, except for certain species designated as “fully protected” under the California Fish and Game Code (FGC) (see below). Under Section 2081, take must be incidental to, and not the purpose of, an otherwise lawful activity. Requirements for a Section 2081 permit are similar to those used in the ESA Section 7 process. In general, the requirements include identification of impacts on listed species; development of mitigation measures that minimize and fully mitigate impacts; development of a monitoring plan; and assurance of funding to implement mitigation and monitoring.

Fully Protected Species

Certain species are considered fully protected under the FGC, meaning that the FGC explicitly prohibits all take of individuals of these species, except for take required for scientific research, which may be authorized by CDFG. Section 5050 of the Code lists fully protected amphibians and reptiles, Section 5515 lists fully protected fishes, Section 3511 lists fully protected birds, and Section 4700 lists fully protected mammals.

Other Fish and Game Code Protections

The FGC provides less stringent protection for other species, prohibiting most take, but permitting CDFG to issue regulations authorizing take under certain circumstances. Eggs and nests of all birds are protected under Section 3503, nesting birds (including raptors and passerines) are protected under Sections 3513 and 3503.5, birds of prey are protected under Section 3503.5, migratory non-game birds are protected under Section 3800, and other specified birds are protected under Section 3505.

Lake or Streambed Alteration Agreements (Section 1600 et seq.)

Section 1600 et seq. of the FGC, administered by CDFG, regulates activities that interfere with the natural flow of, or substantially alter the channel, bed, or bank of a lake, river, or stream. Lake and streambed alteration activities are covered under Section 1601 for public agencies and Section 1603 for private parties. Requirements to protect the integrity of biological resources and water quality are often conditions of streambed alteration agreements, administered under Section 1600 et seq.

California Native Plant Protection Act

The California Native Plant Protection Act (CNPPA) of 1977 prohibits importation of rare and endangered plants into California; unauthorized take of rare and endangered plants; and sale of rare and endangered plants (the “threatened” category replaced “rare” when CESA was enacted in 1984).
CESA defers to the CNPPA, which ensures that state-listed plant species are protected when state agencies are involved in projects subject to CEQA. Removal of plants for performance of a public service by a public agency or a publicly or privately owned public utility is exempt from CNPPA.

**Existing Biological Conditions**

**Natural Communities**

Natural communities are communities that are dominated by species native to the area, and that are diverse, regionally uncommon, or of special concern to local, State, and Federal agencies. Table 3 displays the natural communities and acreages present within the project area.

**Table 3  Natural Communities in the Parsons Slough Complex**

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Mudflat</td>
<td>377.6</td>
</tr>
<tr>
<td>Restricted Mudflat</td>
<td>10.4</td>
</tr>
<tr>
<td>Fully Tidal Salt Marsh</td>
<td>33.5</td>
</tr>
<tr>
<td>Restricted Salt marsh</td>
<td>3.2</td>
</tr>
<tr>
<td>Fresh or Brackish Marsh/Channel</td>
<td>0.6</td>
</tr>
<tr>
<td>Subtidal Saltwater Channel</td>
<td>32.9</td>
</tr>
<tr>
<td>Intertidal Saltwater Channel</td>
<td>0.3</td>
</tr>
<tr>
<td>Impounded Fresh Water (Not Included)</td>
<td>9.7</td>
</tr>
<tr>
<td><strong>Total Acreage</strong></td>
<td><strong>468.2</strong></td>
</tr>
</tbody>
</table>

The current distribution of these communities within the Parsons Slough Complex is depicted in an existing conditions report provided in the Draft Parsons Slough Wetland Restoration Plan (Moffatt & Nichol 2008). The following descriptions are based on that report.

**Tidal Mudflat (377.6 acres)**: Mudflat is an intertidal habitat that is usually covered with water at high tide and exposed to the air at low tide. Intertidal mudflat habitat is found at elevations between mean lower low water (MLLW) and the mean tide level. Mudflats are generally devoid of vegetation but may become covered with green algae (*Ulva* and *Enteromorpha* spp.). Intertidal mudflats support a variety of invertebrates that supply a food base for shorebirds, marine mammals, and fishes including sharks and rays.

**Restricted Mudflat (10.4 acres)**: Restricted mudflat habitat is subjected to a muted tidal range. In the Parsons Complex, it occurs only in Whistlestop Lagoon (Figure 1). The tidal range in Whistlestop Lagoon is significantly restricted by culverts.

**Fully Tidal Salt Marsh (33.5 acres)**: Salt marsh is habitat vegetated by persistent emergent plant species. Salt marsh habitat typically occurs at elevations of approximately 4.3 to 5.8 feet. In the Parsons Slough
Complex, tidal salt marsh has been lost by erosion and subsidence and presently only occurs on created islands in the northern half of the Parsons Complex and along the fringes adjacent to upland areas. Bank erosion has significantly decreased the length and width of the habitat islands since they were created. The fully tidal salt marsh habitat within the Parsons Complex occurs in very small patches.

Salt marsh in the Parsons Slough Complex is dominated by pickleweed (Salicornia virginica). Vegetated tidal marsh contributes nutrients to the system and provides habitat for a variety of species including shore crabs (Hemigrapsus oregonensis) and song sparrows (Melospiza melodia) (Van Dyke and Wasson 2005). Many water birds such as great egrets (Ardea alba) use salt marshes as roosting sites during high tides. Although mid- to high-elevation salt marsh tends to be almost a monoculture of pickleweed, high elevation salt marsh at the ecotone between wetland and upland tends to have a higher diversity of vegetation.

**Restricted Salt Marsh (3.2 acres):** Restricted salt marsh is subjected to a muted tidal range. In the Parsons Slough Complex, muted tidal salt marsh occurs along the fringes of Whistlestop Lagoon. Wasson and Woolfolk (2007) identified only two native salt marsh plant species in the wetland/upland ecotone of Whistlestop Lagoon. These species were pickleweed and spearscale (Atriplex triangularis). The study also recorded one native upland species, coyote bush (Baccharis pilularis) and five upland non-native species. The ecotone study, which compared muted and full tidal sites at several locations in Elkhorn Slough, found that sites with tidal muting had a narrower ecotone width and lower total species richness, lower marsh species richness, and lower species diversity compared to fully tidal sites (Wasson and Woolfolk 2007).

**Brackish/Fresh Marsh (0.6 acres):** This marsh habitat fringes the edges of the “Second Finger” (of the “Five Fingers”) and is not included within the study area. Brackish marsh habitat consists of water that is saline but well below the salinity of seawater (approximately 0.5 to 18 parts per thousand [ppt]). This habitat supports plant and animal species that are adapted for a range of saltwater to freshwater conditions. Characteristic vegetation includes California bulrush (Scirpus californicus), cattail (Typha spp.) and pickleweed.

**Impounded Freshwater Ponds (9.7 acres):** This habitat consists of non-tidal freshwater habitat behind a levee. This habitat is represented by several ponds, including the Rookery Ponds, Upper and Lower Cattail Swale, Five Fingers Pond, and the Barn Ponds in the Parsons Slough Complex. These ponds were created by diking off small portions of marsh in the early half of the last century. The ponds are fed by rainwater and groundwater and receive no tidal influence, and thus are not expected to be affected by the proposed project. The Rookery and Cattail ponds support sensitive reptiles and amphibians including western pond turtle (Emys [Clemmys] marmorata), California red-legged frog (Rana draytonii), and Santa Cruz long-toed salamander (Ambystoma macrodactylum croceum).

**Saltwater Channel (subtidal 32.9 acres, intertidal 0.3 acres):** Saltwater channels generally occur below MLLW and, thus, are permanently covered with water. Approximately 0.3 acres on the edges of the channels are exposed at low tides. The saltwater channels in the Parsons Complex are subjected to the full tidal range. They form a network amongst mudflats and salt marsh and connect to the main channel of Elkhorn Slough. These channels serve as nurseries and foraging areas for many species of fish as well as piscivorous birds, harbor seals and sea otters. They convey sediments and nutrients between...
mudflats and salt marsh habitats and the main channel. The proposed sill would be located in the Parsons Slough channel.

Invasive Species

A major threat to Elkhorn Slough’s estuarine habitats is biological invasion by non-native species. Estuaries are by far the most highly invaded coastal habitat types (Wasson et al. 2005). Between the 1930s and 1970s, the majority of these invaders probably arrived with shipments of non-native oysters that were cultured at Elkhorn Slough. Since then, the main introduction route is via hull-fouling on small boats traveling to Moss Landing Harbor. Some of these invasive species are having significant effects on native communities. Marine and estuarine invasions have been shown to cause local extinction of native competitors and prey organisms, alteration of community composition and food webs, change in physical habitat structure, and even alteration of flow of energy and materials through whole ecosystems (Grosholz 2002).

About 60 non-native invertebrates have been documented at Elkhorn Slough (Wasson et al. 2001). Non-native species such as the Japanese mud snail (*Batillaria attramentaria*) and Australian isopod (*Sphaeroma quoyanum*) currently account for about half the cover on hard substrates, and a quarter of the biomass in soft sediments in Elkhorn Slough, and have displaced native species (Wasson et al. 2001).

In addition to aquatic invaders, non-native upland species have invaded Elkhorn Slough habitats. More than 30 terrestrial non-native plants have been found in the high marsh in the watershed, and these account for about 15 percent of cover in this rich, narrow transition zone to the upland (Wasson and Woolfolk 2007). In some places, non-native species such as poison hemlock (*Conium maculatum*) and ice plant (*Mesembryanthemum crystallinum*) form a virtual monoculture, accounting for the majority of cover in the marsh upland ecotone.

Only four non-native fish species, including striped bass (*Morone saxatilis*), have been reported in Elkhorn Slough (Yoklavich et al. 2002). These non-native species have become widely established throughout California and are unlikely to be eradicated.

Estuarine Fisheries

Information on the fishes of Elkhorn Slough, including the Parsons Slough Complex is summarized in Yoklavich et al. (2002) and presented in (Moffatt & Nichol 2008). The fish fauna of Elkhorn Slough is abundant, diverse and dominated by marine and estuarine species. At least 102 fish species have been identified in Elkhorn Slough and adjacent waters, but the majority (82 species) of these are marine fishes from Monterey Bay. Sixteen of these marine species, including northern anchovy (*Engraulis mordax*) and Pacific herring (*Clupea pallasi*) use Elkhorn Slough as a spawning or nursery ground. Eight fish species, including various gobies, are permanent residents that spawn and complete their entire life cycle in Elkhorn Slough. Six other species, including leopard sharks (*Triakis semifasciata*) and bat rays (*Myliobatis californica*), are considered partial residents; they primarily live and reproduce in the slough but move out to the ocean during some seasons or life stages. Six species, including prickly sculpins (*Cottus asper*) and threespine sticklebacks (*Gasterosteus aculeatus*), are primarily associated with
freshwater. Notably, only four non-native species, including striped bass, have been reported from Elkhorn Slough.

From the 1970s to the 1990s, several detailed surveys were conducted in the main Elkhorn Slough channel and tidal creeks, including the main Parsons Slough tidal channel. During that time, fish assemblages changed. In the 1970s, the species composition near the mouth of Elkhorn Slough was very different from those of the tidal creeks. By the 1990s, however, those geographical differences had disappeared and assemblages in the tidal creeks resembled those of lower Elkhorn Slough. These changes in fish assemblages coincide with the continued erosion and scouring of the Elkhorn Slough Complex, which has resulted in the geomorphology of the tidal creeks becoming more similar to that of the main Elkhorn Slough channel.

Table 4 compares the fish assemblage in the Parsons Slough channel during the periods of 1974-1980 and 1995-1996. During 1974-1980, the Parsons Slough main channel supported seven dominant fish species and the assemblage was estuarine in character. In 1995-1996, the Parsons Slough channel samples were dominated by only three species including northern anchovy and Pacific herring, which are both marine immigrants. Thus the fish assemblage in Parsons Slough had changed from one dominated by estuarine species to one dominated by marine species.

More recent surveys of fishes were conducted in the northern portion of the Parsons Slough Complex in 2005. Fish species found during these surveys included topsmelt (Atherinops affinis), shiner surfperch (Cymatogaster aggregata), longjaw mudsucker (Gillichthys mirabilis), Pacific staghorn sculpin (Leptocottus armatus), California halibut (Paralichthys californicus), thornback (Platyrhinodis triseriata), plainfin midshipman (Porichthys notatus), northern anchovy, bay pipefish (Syngnathus leptorhynchus), and fantail sole (Xystreurys lioplepis) (Moffatt & Nichol 2008).

The Parsons Slough Complex is also heavily used by various species of sharks and rays for foraging and pupping. Seven species of sharks and rays commonly inhabit Elkhorn Slough, including Parsons Slough. These are leopard sharks, bat rays, shovelnose guitarfish (Rhinobatos productus), thornbacks, gray smoothhounds (Mustelus californicus), brown smoothhounds (Mustelus henlei), and round stingrays (Urolobatis halleri) (Carlisle 2006). In a study of movements and habitat use of tagged female leopard sharks in Elkhorn Slough, Carlisle (2006) found that Parsons Slough was being used extensively throughout the year, but especially during spring and summer. The Parsons Slough Complex appears to be important as both a foraging and nursery area, probably due to the large amount of intertidal mudflats, which support abundant prey items for the sharks.
Table 4  Fish Species and Relative Abundances in Parsons Slough during the Periods of 1974-1980 and 1995-1996

<table>
<thead>
<tr>
<th>Species</th>
<th>Life Style*</th>
<th>Abundance Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stary flounder (Platichthys stellatus)</td>
<td>MI</td>
<td>5.9%</td>
</tr>
<tr>
<td>Black surfperch (Embiotica jacksoni)</td>
<td>R</td>
<td>3.7%</td>
</tr>
<tr>
<td>Pacific staghorn sculpin (Leptocottus armatus)</td>
<td>R</td>
<td>51.2%</td>
</tr>
<tr>
<td>Queenfish (Seriphus politus)</td>
<td>MI</td>
<td>9.5%</td>
</tr>
<tr>
<td>Topsmelt (Atherinops affinis)</td>
<td>PR</td>
<td>4.9%</td>
</tr>
<tr>
<td>Arrow goby (Clevelandia ios)</td>
<td>R</td>
<td>3.7%</td>
</tr>
<tr>
<td>Leopard shark (Triakis semifasciata)</td>
<td>PR</td>
<td>3.7%</td>
</tr>
<tr>
<td>Shiner surfperch (Cymatogaster aggregate)</td>
<td>PR</td>
<td>--</td>
</tr>
<tr>
<td>Northern anchovy (Engraulis mordax)</td>
<td>MI</td>
<td>--</td>
</tr>
<tr>
<td>Pacific herring (Clupea pallisi)</td>
<td>MI</td>
<td>--</td>
</tr>
</tbody>
</table>

* Life Style: MI = marine immigrant; R = resident; PR = partial resident
(Source: Yoklavich et al. 2002; Moffatt & Nichol, 2008)

Special-Status Species

Special-Status Plants

Special-status plants with potential to occur in the Elkhorn Slough estuary and surrounding uplands are provided in Table 1 of this report. A complete list of all common and special-status species, with potential to occur in the Elkhorn Slough watershed is provided in Appendix 5 - Habitats and Species in the Elkhorn Slough National Estuarine Research Reserve Final Management Plan 2007-2011 (ESNERR 2006).

Intertidal mudflats near the sill site and Kirby Park do not support vegetation. The staging area at Kirby Park contains native salt marsh vegetation in areas outside the paved parking lot; however, these areas are outside the project footprint and would not be disturbed during project activities. Salt marsh vegetation, dominated by pickleweed and salt grass, is found on the UPRR embankments and surrounding tidal marsh adjacent to the proposed sill location; however, no special-status plants have been noted in this area.

Implementation of project best management practices (BMPs) would prevent unintentional temporary disturbance to vegetation in the vicinity of Kirby Park staging area. Erosion control BMPs to protect vegetation may include installation of silt fences, fiber rolls along the toes of slopes or along the edges of designated staging areas, and/or erosion control netting (such as jute or coir) as appropriate on sloped areas.
The larger Elkhorn Slough does contain sensitive plant species. Rare plant surveys conducted in 2007 documented six native salt marsh plant species in the high marsh/upland ecotone in the “Five Fingers” area of the Parsons Slough Complex. These salt marsh species were pickleweed, salt marsh dodder (Cuscuta salina), salt grass (Distichlis spicata), alkali heath (Frankenia salina), fat hen (Atriplex triangularis), and fleshy jaumea (Jaumea carnosa). The ecotone also supports various native and non-native, upland plant species such as poison hemlock and ice plant. Portions of the estuary support aquatic eelgrass, which provides important habitat for southern sea otters and a wide variety of invertebrate and fish species. A reduced tidal prism resulting from installation of the sill could result in increased eelgrass populations in Elkhorn Slough by decreasing erosion of its substrate.

Construction of the sill would not directly alter or impact habitat for special-status plants. Changes to the tidal regime in Parsons Slough would provide an overall (long-term) increase in tidal wetland vegetation through reduction of tidal scour. The indirect impact of reducing erosion and the possible decrease of approximately 8 acres of un-vegetated mudflat would provide an increase of approximately one acre of salt marsh vegetation in Parsons Slough.

**Special-Status Fish and Wildlife**

The region currently supports a variety of vegetation communities and aquatic habitats that are essential for the dispersal, refuge, breeding, and foraging activities of common and special-status fish and wildlife species. The database searches identified 46 special-status wildlife and fish species that may potentially occur in the project region. Table 2 includes a summary of the species with potential to occur in the region and the reason each species would or would not occur in the project area. Species known to occur – or with some potential to occur – in the project area are discussed in further detail below.

**Fish**

Special-status fish species potentially occurring with the Elkhorn Slough complex include the Southern DPS of North American green sturgeon, tidewater goby (Eucyclogobius newberryi), and three listed salmonid species: coho salmon (Oncorhynchus kisutch), Chinook salmon (O. tshawatscha), and steelhead (O. mykiss). The potential for each of these species to occur within Elkhorn Slough in general, and within the proposed project area in particular, is discussed below.

**Green Sturgeon**

There are little data on green sturgeon presence in, and use of, Elkhorn Slough. One green sturgeon of unknown DPS was impinged and died at the Moss Landing Power Plant in 2006 (Tenera 2007). An unconfirmed occurrence of the species within “Elkhorn Slough and adjacent areas (i.e., Moss Landing Harbor, Jetties Slough, and Bennett Slough)” in surveys from the 1970s to 1990s is reported by Yoklavich et al. (2002), but a thorough review of the same survey results by Brown (2002) did not reveal any green sturgeon observations. More recent surveys conducted in 2008 and 2010 within the project area did not result in green sturgeon observations (Ritter et al. 2008, Fountain pers. comm. 2010). Based on available data and informal discussions with NMFS staff, it was determined that while green sturgeon may at times stray into Elkhorn Slough, their occurrences are deemed sufficiently infrequent that the proposed action would be unlikely to affect the species.
Tidewater Goby

The tidewater goby is a Federal endangered species inhabiting brackish to fresh water habitats along the California coast from Tillas Slough in Del Norte County south to Agua Hedionda lagoon in San Diego County. Tidewater gobies range upstream a short distance into freshwater and downstream into water of up to about 75 percent sea water (28 ppt) (USFWS 2005). The species typically is found in salinities of less than 12 ppt in shallow lagoons and lower stream reaches where slow moving or still, but not stagnant, water is found with high oxygen levels (USFWS 2005). Tidewater gobies are known to occur in Bennett Slough and Moro Cojo Slough (CNDDB 2010), both of which are part of the overall Elkhorn Slough Estuary. Furthermore, Bennett Slough has been Federally designated as a critical habitat recovery unit (MNT-1) for the species (73 FR 5920).

Tidewater gobies are not known to occur in the project area (Moffatt & Nichol 2008). A recent study by Ritter et al. (2008) of different tidal regimes in Elkhorn Slough found tidewater gobies only at sites with minimal tidal flow. These sites were in the Mojo Cojo Slough system, which is south of Elkhorn Slough and Struve Pond, which is located northeast of the mouth of Elkhorn Slough (Moffatt & Nichol 2008). Although tidewater gobies have a high potential to occur in two slough complexes that are part of the overall Elkhorn Slough Complex (Bennett and Moro Cojo), the species’ dependence on low tidal flows is expected to exclude it from the main channel of Elkhorn Slough as well as the Parsons Slough Complex. Furthermore, Bennett and Moro Cojo sloughs are under a muted tidal regime and are not expected to be affected by construction of the proposed sill.

Salmonids

Three listed salmonid species occur in the waters of Monterey Bay: coho salmon, Chinook salmon, and steelhead. Listed coho and Chinook salmon are grouped into Evolutionarily Significant Units (ESUs) depending on the geographic location of their spawning sites and/or the timing of their spawning migrations. Steelhead are grouped into DPSs according to their spawning site locals. Depending on the ESU and/or DPS, listed salmonids in Monterey Bay may be Federally listed as endangered or threatened, or not listed.

Coho and Chinook salmon do not spawn as far south as Elkhorn Slough; however, while coho salmon have not been reported within Elkhorn Slough, Chinook salmon of unknown origin have occasionally been recorded in Elkhorn Slough (Yoklavich et al. 2002). Tenera (2007) reported hatchery-origin juvenile Chinook salmon from the intakes of the Moss Landing Power Plant in Moss Landing Harbor. Steelhead spawn in coastal and inland streams of California as far south as the U.S.-Mexico border. Steelhead of unknown origin have been reported from Elkhorn Slough (Yoklavich et al. 2002). South-central coast steelhead are known to spawn in Gabilan Creek, which is connected to Moss Landing Harbor via Alisal Slough, Tembladero Slough and the Old Salinas River channel, which connects Elkhorn Slough to the current estuary of the Salinas River (Boughton et al. 2006). As such, both adult and juvenile steelhead may migrate through the harbor, and may occasionally enter other portions of Elkhorn Slough.

Based on discussions with NMFS staff, it was determined that while all three salmonid species may at times stray into the Elkhorn Slough action area, including the Parsons Slough study area, their occurrences are deemed sufficiently infrequent that the proposed action would be unlikely to affect these species.
Invertebrates

Over 550 species of marine invertebrates belonging to 16 phyla have been reported for Elkhorn Slough (Wasson et al. 2002). Three taxa of invertebrates (polychaetes, crustaceans, and bivalves) dominate the slough’s benthic infauna, as they do other soft-bottom communities around the world. Each of these three groups is represented by well over 100 species at the slough (Wasson et al. 2002), but many smaller taxa are also represented. In addition to its diverse native fauna, the slough hosts many non-native species.

Although no State or Federally listed aquatic invertebrates are known to occur in Elkhorn Slough (CDFG 2010), two rare species, California brackish water snail (=mimic tryonia) (Tryonia imitator) and Olympia oyster (Ostrea lurida), are known to occur within Parsons Slough.

California Brackish Water Snail

The California brackish water snail was formerly considered a Federal species of concern (a status no longer recognized by USFWS). This is a small gastropod inhabiting coastal lagoons and salt marshes from Sonoma County in the north to San Diego County in the south. California brackish water snails inhabit a variety of subtidal sediment types and are able to withstand a wide range of salinities. Several occurrences have been reported from Bennett Slough, Moro Cojo Slough, and Parsons Slough (CNDDB 2010); however, during two recent studies, the species occurred almost exclusively in muted or minimally tidal areas of the Elkhorn Slough Complex. These surveys found no California brackish water snails in the project area in 2005 (Ritter et al. 2008) and only one individual in 2007-2008 (Oliver et al. 2009). Both studies suggest that tidal flushing in Parsons Slough may be excessive for successful colonization by California brackish water snails (Ritter et al. 2008; Oliver et al. 2009). For this reason, California brackish water snails are considered locally rare under CEQA.

Olympia Oyster

The Olympia oyster is a native species of oyster limited almost entirely to estuaries along the Pacific Coast of North America. Their numbers have declined greatly in the past century due to habitat loss, poor water quality, over harvesting, sedimentation, and introduction of non-native predators and competitors. The current Elkhorn Slough population size is estimated at only 5,000 to 10,000 individuals. It is estimated that the oyster population in the Parsons Slough Complex represents about 10 percent of the population in the larger Elkhorn Slough Estuary, or 500 to 1,000 individuals. To the south of Elkhorn Slough, the next known Olympia oyster population is in Mugu Lagoon, Ventura County; to the north, the next population is in San Francisco Bay. The Elkhorn Slough population of Olympia oysters, evident in the archaeological record for the past 10,000 years, provides connectivity between northern and southern California populations and supports ecosystem functions typically associated with healthy oyster beds, including improved water quality, shoreline protection, and increased fish and invertebrate diversity.

Recent monitoring efforts by researchers with the Elkhorn Slough National Estuarine Research Reserve (ESNERR) have found that Parsons Slough and the Azevedo wetland complex (about 0.5 miles north of Parsons Slough) currently support some of the densest adult oyster populations on available hard substrates within Elkhorn Slough, and the highest recruitment rates in the estuary; however, total oyster
populations in these areas are small because very few hard substrates, which help oysters avoid burial in the mud, are available for oyster recruitment. The proposed Olympia oyster restoration effort associated with the project would address this limiting factor by creating new hard substrate for the oysters to populate.

Olympia oysters provide food resources to various species of sharks and rays. Olympia oysters can represent an important component of the diet of crabs (*Cancer* spp.), which in turn make up a percentage of the southern sea otter diet (Baker 1995).

**Amphibians**

Three listed amphibians occur in the watershed: the Santa Cruz long-toed salamander, the California tiger salamander, and the California red-legged frog. Although many freshwater springs, wet meadows, marshes, and shallow lakes have been lost in north Monterey County over the last 150 years, some of these habitats, either natural or artificial, do persist in the Elkhorn Slough watershed. Today, natural freshwater meadow habitat can be found on the valley floor of Long Valley and in areas of Porter Ranch. Natural freshwater marsh remains in portions of south Strawberry Marsh, at the confluence of Porter Marsh and Corncob Canyon Creek, in the lowest reaches of Carneros Creek, and in portions of McClusky Slough. Several natural ponds remain throughout the watershed. Artificial ponds are scattered throughout the watershed and greatly outnumber natural pond sites. A significant impact to the persistence of these amphibians is the presence of the introduced American Bullfrog (*Rana catesbeiana*) and non-native predatory fish species that occur throughout the watershed (primarily at long-lived or permanent wetlands).

Amphibian dependence on freshwater habitats excludes them from the main channel of Elkhorn Slough as well as the Parsons Slough Complex. Any protection that the placement of the sill gives against sea level rise may in fact benefit amphibians that are breeding in diked off areas that were formerly salt marsh. The proposed project area does not contain suitable habitat for these species and project activities would not affect abundance and quality of freshwater aquatic habitat in the Elkhorn Slough watershed.

**Birds**

**Special Status and Migratory Birds**

Elkhorn Slough is recognized as a Globally Important Bird Area by the American Bird Conservancy. More than 265 bird species (73 percent of the California total) have been recorded in the Elkhorn Slough area. Most are seasonal visitors, but approximately 40 are year-round residents. Aquatic birds — shorebirds, seabirds, herons, and waterfowl — account for much of the slough’s avian diversity. As one of the largest estuaries in California, Elkhorn Slough is a major stopover for birds migrating along the Pacific flyway. More than 20,000 sandpipers, plovers, and their relatives may be present at the peak of migration (Ramer et al. 1991). A number of these aquatic species nest in the Elkhorn Slough, including great egrets, great blue herons (*Ardea herodias*) and double-crested cormorants (*Phalacrocorax auritus*). Caspian terns (*Sterna caspia*) nest on man-made islands in the area, and the Federally-listed Western snowy plover (*Charadrius alexandrinus nivosus*) is a known breeder in portions of the greater Elkhorn
Slough. The recently de-listed California brown pelican (*Pelecanus occidentalis*) roosts in the project area. The Western snowy plover and California brown pelican are discussed in more detail below.

**Western Snowy Plover**

The Western snowy plover is a Federally threatened species. This plover is a small shorebird that nests on coastal sandy beaches and the shores of salt ponds and alkaline lakes. The sandy, silty bottoms of the former salt ponds in Elkhorn Slough provide ideal nesting sites for the snowy plover and are the most productive snowy plover habitat in the Monterey Bay region. They also nest along the beach near Moss Landing Harbor. Snowy plovers forage for insects and marine invertebrates in wet sand along the edge of the water. Though snowy plovers may occasionally forage on intertidal mudflats in the Parsons Slough Complex and adjacent to the Kirby Park staging area, there is no suitable nesting habitat for this species within the project area.

**California Brown Pelican**

The California brown pelican was recently de-listed from its endangered status under both the ESA and CESA but remains a California fully protected species under FGC 3511. Pelicans breed in nesting colonies on islands without mammal predators. They typically build a nest of sticks on the ground. In California, they feed primarily on Pacific mackerel, Pacific sardine, and northern anchovy. Anchovies compose 90 percent of their diet during the breeding season.

Roosting and loafing sites provide important resting habitat for breeding and non-breeding birds. Important roosting sites include offshore rocks and islands, river mouths with sand bars, breakwaters, pilings, and jetties along the Pacific Coast and San Francisco Bay. Any threats to roosting or fishing resources can affect them. Human activity, off-leash dogs, and small fishing boats nearshore pose a threat to these roosting areas.

Brown pelicans roost at the Elkhorn Slough Reserve in highest numbers between July and October. Reports of up to 5,000 pelicans have been recorded in the Elkhorn Slough vicinity. More than 1,000 pelicans have been observed roosting along the steep banks of the lower slough (Harvey and Connors 2002). Within the project area, pelicans roost in the open water habitats.

**Special Status Raptors**

Upland habitat surrounding the proposed project area contains suitable habitat for special-status raptors. Active raptor nests are protected under FGC Section 3503.5. Raptor species that could use the project vicinity for nesting include northern harrier (*Circus cyaneus*), western burrowing owl (*Athene cunicularia hypugea*), and short-eared owl (*Asio flammeus*). These ground-nesting raptors may inhabit upland and salt marsh habitats throughout, and adjacent to, the project area. Though no focused surveys have been conducted, the large, mature eucalyptus trees located in the vicinity of Parsons Slough could support tree-nesting raptors such as red-tailed hawk (*Buteo jamaicensis*) and white-tailed kite (*Elanus leucurus*). White-tailed kite nesting sites are designated as fully protected under FGC Section 3511.
**Mammals**

Five marine mammal species have been observed in Elkhorn Slough. California sea lion (*Zalophus californianus*), harbor porpoise (*Phocoena phocoena*), and juvenile gray whale (*Eschrichtius robustus*) are sighted infrequently in the lower reaches of the slough but not in the project area (Richman 1997). Only the southern sea otter and harbor seal are consistently present in the channel waters of Elkhorn Slough (Harvey and Connors 2002). The southern sea otter and harbor seal occupy saltwater channel, subtidal and intertidal (mudflat) habitat within the Parsons Slough Complex. These habitats serve as nurseries and foraging areas for these two species of marine mammals (Maldini et al. 2010). All species of marine mammals are protected under the MMPA, but this analysis only considers harbor seals and sea otters because they occupy the project area.

**Southern Sea Otter**

In 1977, the sea otter was listed as a Federally threatened species (42 FR 2968) under the ESA, and is designated by the State as a fully protected species under CESA (FGC Section 4700). In 2003, the USFWS prepared a Recovery Plan for sea otter (USFWS 2003). USFWS has not designated critical habitat for this species. As with all marine mammals, the sea otter is protected under the MMPA; because of its Federal ESA status, the southern sea otter is considered by default to be a “strategic stock” and “depleted” under the MMPA.

The species current range includes the mainland coastline of California from San Mateo County to Santa Barbara County (USFWS 2008). Trends suggest the southern sea otter population is stable or slightly declining (USGS 2009). The status of the southern sea otter stock in relation to its optimum sustainable population (OSP) level (as defined under the MMPA) has not been formally determined, but population counts are well below the estimated lower bound of the OSP level for southern sea otters, about 8,400 animals (USFWS 2003), which is roughly 50 percent of the estimated carrying capacity of California (Laidre et al. 2001). The decline observed in southern sea otter recovery may be the result of low genetic diversity as it contributes to the higher than expected rates of disease susceptibility (Tinker et al. 2006).

Sea otters occupy hard- and soft-sediment marine habitats from the littoral zone to depths of less than 330 feet (100 meters), including protected bays and exposed outer coasts. Most individuals occur between shore and the 65 foot (20 meter) depth contour (USFWS 2003). Daily movements generally encompass a few kilometers (Riedman and Estes 1990). Sea otters are considered keystone predators in rocky-bottom environments where some of the preferred prey species, such as sea urchin and abalone, are herbivores that regulate the growth of macrophytic algae and primary productivity (Estes et al. 2003). Sea otters can also have large impacts on soft-sediment communities such as those found in the Elkhorn Slough Complex.

In California, most births occur from late February to early April but births may occur throughout the year, and the birth peak may extend over several months (Riedman et al. 1994). The peak pupping season in Elkhorn Slough occurs in March and April (Maldini et al. 2010). Current counts for Elkhorn Slough indicate a population of approximately 100 individuals or 3.5 percent of the southern sea otter population (Maldini et al. 2010).
There are currently 17 to 28 sea otters using the Parsons Slough Complex and adjacent Yampah Island (Maldini et al. 2010). There are three main sea otter resting areas in and adjacent to the project area. Each of the three areas consists of a dominant male and associated females and pups. Foraging in Parsons Slough occurs in minor tidal channels, which have similar prey composition compared to other areas of Elkhorn Slough (Moss Landing Marine Laboratories 2007), but the shallow bottom in Parsons Slough may provide easier access to this prey (McCarthy in press). In addition, prey abundance remains high because prey populations in Parsons Slough have not been depleted by foraging otters.

While in Parsons Slough, 62 percent of the otters appear to be resting, either in the water or hauled out in pickleweed vegetation. Haul-out behavior in marsh vegetation appears to be unique to Parsons Slough otters. Unlike Parsons Slough otters, the sea otters in North Harbor (at the mouth of Elkhorn Slough) do not exhibit haul out behavior during the daytime. This unusual daytime haul-out behavior exhibited by Parsons Slough otters may be due to absence of disturbance (Maldini et al. 2010).

Harbor Seal

Harbor seals are protected under the MMPA, but are not listed as threatened or endangered under the ESA or CESA. Harbor seals are nonmigratory marine mammals found in subarctic and temperate waters of the North Atlantic and North Pacific Oceans and contiguous seas. They live in temperate coastal habitats and use rocks, reefs, beaches, and drifting glacial ice as haul-out and pupping sites. Harbor seals haul out on land for rest, thermal regulation, social interaction, and to give birth. They generally are found near shore in estuaries or protected waters, but may range far out to sea in deep pelagic waters or up freshwater rivers and into lakes (Marine Mammal Commission 2002).

Harbor seals use Elkhorn Slough for hauling out, resting, socializing, foraging, molting, and reproduction. Some seals may depart during pupping/breeding season, which peaks in May on the central California coast. There are an estimated 100 harbor seals using the Parsons Slough Complex on a daily basis (Maldini et al. 2010). Harbor seals in Parsons Slough use exposed mudflats during low tide to haul out. There are five main haul-out areas for harbor seals within the Parsons Slough Complex and one haul-out site at the entrance, just south and west of the UPRR bridge (Maldini et al. 2010). Consistent with harbor seal behavior, abundance on the mudflats is highest during the day and drops after sunset. Activity at night is unknown, but researchers speculate that harbor seals leave Parsons Slough at night to forage in the main channel or Monterey Bay (Maldini et al. 2010).
References

Personal Communications

Eby, R., Biologist. Conversations between Eby, OKEANIS, and Brook Vinnedge, Vinnedge Environmental Consulting, during the Marine Mammal Working Group Meetings held on December 16, 2009 and January 29, 2010.

Fountain, M., Tidal Wetland Project Manager. 2010. Email communication between Fountain, Elkhorn Slough National Estuarine Research Reserve, and Mike Podlech regarding recent fish surveys in Parsons Slough. May 18.

Wasson, K., ESNERR Research Coordinator. Comments received on draft Biological Resources Report. March 2010.

Literature Cited


Appendix C

Hydrology and Water Quality Background
HYDROLOGY, WATER QUALITY, AND GEOMORPHOLOGY
Parsons Slough Project

PREPARED FOR:
California Department of Fish and Game
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4005

PREPARED BY:
Vinnedge Environmental Consulting
1800 Grant Street
Berkeley, California 94703
(510) 665-7885

in association with
Wetlands and Water Resources, Inc.

April 2010
Table of Contents

**Hydrology, Water Quality, and Geomorphology** .................................................. 1

1.1 Environmental Setting ............................................................................................ 1
   1.1.1 Geographic Setting and Land Use History.......................................................... 1
   1.1.2 Tides ................................................................................................................. 3
   1.1.3 Watershed Inputs ............................................................................................... 6
   1.1.4 Water Quality ..................................................................................................... 7
   1.1.5 Geomorphology ................................................................................................. 15

References ..................................................................................................................... 17
   Personal Communications ........................................................................................... 17
   Literature Cited .......................................................................................................... 17

Figures
Hydrology, Water Quality, and Geomorphology

This report describes the hydrologic, water quality, and geomorphic (land-form) conditions on and in the vicinity of the project area, including tidal hydraulics, surface water and groundwater hydrology, sedimentation and erosion, and the potential for eutrophication. Processes and other baseline factors affecting water quality conditions and existing water quality data are presented in this report. Figure 1 illustrates the boundary of the project area, including several key locations within Parsons Slough referred to in the following section.

1.1 Environmental Setting

Existing hydrologic, water quality, and geomorphic conditions within Parsons Slough have been largely determined by forces operating on two different time scales: the long-term physical forces shaping the Monterey Canyon and the Elkhorn Slough basin, and the more recent history of intensive land use within and human modifications to the Elkhorn-Parsons Slough system. These conditions are discussed in detail below.

1.1.1 Geographic Setting and Land Use History

Parsons Slough is part of the greater Elkhorn Slough system, an intertidal network of tidal marshes, mudflats, and subtidal channels located at the center of the Monterey Bay shoreline. In order to understand the relationship between Elkhorn Slough and Parsons Slough and their surrounding landscapes, it is important to note that Elkhorn Slough forms the most headward portion of the largely-submerged Monterey Canyon, a dominant bathymetric feature along the California coast that reaches maximum depths of over 10,000 feet below the Pacific surface (Figure 2). The presence of the canyon immediately downstream of the slough has important implications for erosion and sedimentation, which are further discussed below in section 1.1.5, Geomorphology.

Elkhorn Slough has a complex evolutionary history that is explained in detail by a number of documents published by Elkhorn Slough National Estuarine Research Reserve (ESNERR) scientists and others (Van Dyke and Wasson 2005, PWA 2008). Of relevance to this analysis is the site’s modern history (approximately the past 150 years). Within this time period, and before construction of Moss Landing Harbor and its associated jetties in 1946, Elkhorn Slough was most likely not a fully tidal system. During this time, the slough was most likely intermittently open to the Pacific Ocean, and often shared a common outlet with the Salinas River, Moro Cojo Slough, and Tembladero Slough (Figure 3). Like many estuaries and lagoons along California’s Central Coast, tidal exchange between Monterey Bay and Elkhorn Slough was often choked by a sandbar (beach berm) and a complex series of flood-tide shoals at this shared outlet (Figure 4) (MacGinitie 1935, PWA 2008). The outlet most likely changed in location, orientation, and closure status depending on the interactions between estuarine flows, angles of swell...
approach within Monterey Bay, eolian sand deposition, human intervention, and other temporally and spatially variable factors.

The Salinas River contributed significant amounts of sediment and freshwater to the slough system, resulting in the predominance of freshwater and brackish communities within slough habitats. In the early 1900s, a combination of powerful storms and intervention by local residents forced the outlet of the Salinas through sand dunes 5 miles to the south, isolating it from Elkhorn Slough and forcing the estuary to transition into a primarily saltwater system (PWA 2008, Caffrey et al. 2002). While the Salinas likely naturally occupied this southern outlet occasionally, especially during high-flow-events, it was never again allowed to re-occupy its northern, shared outlet with Elkhorn Slough. This diversion removed the single largest source of suspended sediment to the slough, significantly reducing the amount of material available for accretion (deposition) onto the marsh plain (PWA 2008). Alterations to the Pajaro River may also have removed another significant source of freshwater and sediment to Elkhorn Slough, but there is currently little evidence to support these claims (PWA 2008).

The construction of Moss Landing Harbor in 1946 dramatically altered the hydrodynamics in Elkhorn Slough by permanently opening the system to the full range of tidal action. The new outlet’s dredged location was directly in line with the mainstem of Elkhorn Slough, allowing tides to enter the slough with much less resistance than before. This dramatically increased the tidal energy within the system, increasing rates of sediment transport; this sediment was then exported out of the slough into Monterey Bay (and Monterey Canyon) on ebb tides. The permanent loss of this sediment is a major factor driving the conversion of tidal marsh to unvegetated mudflat within the entire Elkhorn Slough system, including Parsons Slough (Caffrey et al. 2002, Van Dyke and Wasson 2005, ESNERR 2007).

Within Parsons Slough, the loss of sediment due to increased tidal erosion was not the only factor contributing to morphological changes within the marsh. In 1903, members of the Empire Gun Club constructed two waterfowl ponds out of the tidal marsh on the eastern side of the Union Pacific Railroad (UPRR) embankment (constructed in 1872), in an area now known as “South Marsh.” These ponds were maintained as freshwater environments through a combination of levees and a system that piped in water from nearby springs. In the 1920s, the Empire Gun Club property was purchased by J. Henry Meyer and incorporated into Meyer’s Elkhorn Dairy. Between 1949 and 1956, the entire marsh complex east of the railroad embankment was diked and drained in order to convert tidal marsh habitats to dairy pasture (Figure 5). The use of the site as pasture continued until the entire marsh complex was purchased by the State of California in 1980 and designated a National Estuarine Research Reserve. A combination of storm-induced and intentional levee breaches in the winter of 1982-1983 restored tidal action to the whole of Parsons Slough. During the time the slough was used as pasture, it experienced significant amounts of compaction and subsidence due to the oxidation of organic marsh peats, resulting in an overall lowering of that portion of the slough below elevations suitable to support tidal marsh (Caffrey et al. 2002, ESNERR 2007). In the early 1980s, the California Department of Fish and Game (CDFG) and ESNERR attempted to encourage the establishment of tidal marsh within South Marsh by dredging material from intertidal and subtidal areas and placing this material on top of intertidal areas until these areas were high enough to support tidal marsh. The idea behind this design was that tidal marsh would laterally spread from these areas as they accreted mineral soils and organic matter.
(Caffrey et al. 2002). The design did not entirely work as planned, but South Marsh continues to host the largest portion of tidal marsh within the Parsons system (see section 1.1.5, Geomorphology, below).

1.1.2 Tides

**Tidal Datums and Lag Times**

The National Oceanic and Atmospheric Administration’s Center for Operational Oceanographic Products and Services (NOAA CO-OPS) maintains a network of tidal water level monitoring stations throughout Monterey Bay and Elkhorn Slough. These stations include one station, #941-3631 (Elkhorn Slough at Elkhorn, or ES-E), immediately outside the Parsons Slough channel within Elkhorn Slough. Additional stations are located at the Highway 1 bridge (#941-3616), Moss Landing (#941-3616), and Monterey (#941-3450). The Monterey station is a reference station against which tidal datums for the other subordinate stations are calculated.

The precise elevations of tidal datums within Parsons Slough have been a source of much debate and analysis over the years. The calculation of tidal datums from subordinate stations within the slough system is made exceptionally difficult due to the low levels of stability experienced by the many of the National Geodetic Survey (NGS) benchmarks upon which the tidal elevations are measured. Many of these benchmarks are located on lands that are subsiding at a rate of 4-5 mm per year (Van Dyke pers. comm.). Therefore, the published tidal datums at these stations, especially ES-E, are questionable.

Historic recording of water surface elevations within Parsons Slough has indicated that the slough has a tidal signature almost identical to that of the Monterey reference station (Broenkow and Breaker 2005), though there is a lag time between tides at the two stations. Because confidence in tidal datums at the Monterey station is much higher due to the higher stability of NGS benchmarks at this station, this analysis uses the published tidal datums for the Monterey station. These datums are described below in Table 1.

**Table 1  Tidal Datums within Monterey Bay**

<table>
<thead>
<tr>
<th>Tidal Datum</th>
<th>Elevations at Monterey (941-3450), ft NAVD88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Higher High Water (MHHW)</td>
<td>5.48</td>
</tr>
<tr>
<td>Mean High Water (MHW)</td>
<td>4.77</td>
</tr>
<tr>
<td>Mean Sea Level (MSL)</td>
<td>3.01</td>
</tr>
<tr>
<td>Mean Tide Level (MTL)</td>
<td>2.97</td>
</tr>
<tr>
<td>Mean Low Water (MLW)</td>
<td>1.23</td>
</tr>
<tr>
<td>Mean Lower Low Water (MLLW)</td>
<td>0.14</td>
</tr>
<tr>
<td>Tidal Range (ft)</td>
<td>5.33</td>
</tr>
</tbody>
</table>

Source: NOAA 2010
Whistlestop Lagoon at the extreme northern end of the Parsons system has a muted tidal regime (a tidal range that is smaller than it would otherwise be without tidal constriction), relative to tides in Parsons Slough, due to hydraulic constrictions between the lagoon and the slough. The tidal range in Whistlestop Lagoon is approximately 1 foot, centered around the mean tide level (Moffatt & Nichol 2008).

Different lag times have been measured between tides within Monterey Bay/the head of Elkhorn Slough and the mouth of Parsons Slough. The National Ocean Service in 1976 recorded a 23-minute lag time between high tides at the Highway 1 bridge (near the mouth of Elkhorn Slough) and Kirby Park (upstream of the Parsons Slough entrance within Elkhorn Slough) (Broenkow and Breaker 2005), but this estimate has since been rendered obsolete by the increased tidal prisms within Elkhorn Slough (Malzone 1999). Wong (1989) measured a 48-minute lag time between high tides near the Highway 1 bridge and a location near the Parsons Slough entrance; this same distance experienced an only 18-minute lag between ebb tides (further illustrating the ebb-dominance of the system). Broenkow and Breaker (2005) measured 42-minute and 11-minute lags between high and low tides, respectively, between Moss Landing Harbor and the entrance to Parsons Slough. There is a slight lag (approximately 20 min) between tides at the mouth of Parsons Slough (the UPRR bridge) and the South Marsh area (Moffatt & Nichol 2008); this is most likely due to hydraulic roughness within South Marsh and its distance from the UPRR bridge.

**Tidal Prisms and Hydraulic Residence Times**

The term “tidal prism” refers to the amount of water that gets transported into and out of a tidal basin during a typical, unchoked tidal cycle – in other words, the amount of water within a basin that lies between mean higher high water (MHHW) and mean lower low water (MLLW). The tidal prism of Parsons Slough has been calculated using a variety of different methods. In 1992, PWA calculated the tidal prism of the Parsons complex to be 1.8 million cubic meters (1,464 acre-feet) using regression curves derived from relationships between tidal prisms and marsh areas in San Francisco Bay (Haltiner and Williams 1987). Broenkow and Breaker (2005) used Acoustic Doppler Profile (ADP) data from one ebb tide in November 2002 to measure a tidal prism of 2.4 million cubic meters (1,946 acre-feet). No estimates of the pre-disturbance tidal prism of Parsons Slough exist in the literature; however, evidence of significant downcutting in the main Parsons Slough channel have made clear the severity of the apparent increase (Moffatt & Nichol 2008). While estimates of the total tidal prism within Elkhorn Slough vary, the tidal prism of the Parsons system is described in most of the literature as providing approximately one-third of the tidal prism of the entire Elkhorn Slough complex. Given that the tidal prism of the entire Elkhorn Slough system has approximately tripled since 1956 (ESNERR 2007), the resulting increases in sediment scour and channel downcutting within Parsons Slough and the greater Elkhorn Slough have been significant.

The term “hydraulic residence time,” or HRT, refers to the amount of time it takes water to completely circulate into or out of a system. Within a tidal system such as Parsons Slough, HRT is usually described by the number of tidal cycles it takes to completely flush the tidal prism from a system and replace it with entirely new tidal waters. HRTs in tidal systems can be increased by drainage constrictions such as
culverts and sills, which limit the movement of water and in some cases make it difficult for sites to fully flood and/or drain. Long HRTs are associated with the development of poor water quality conditions, especially decreased levels of dissolved oxygen (DO), because they facilitate the accumulation of nutrients and organic matters within aquatic systems. The HRT of Parsons Slough has been calculated to be 1.5 tidal cycles (Moffatt & Nichol 2009).

**Tidal Flow Velocities**

The increase in tidal action within Elkhorn and Parsons Slough has resulted in an increase in tidal velocities, which in turn increase the amount of material scoured from intertidal and subtidal habitats and exported out of Elkhorn Slough. Studies of both Parsons and Elkhorn Sloughs have found them to be consistently ebb-dominated, meaning that tidal flows on an ebb (receding) tide are faster than flows on a flood tide and therefore capable of mobilizing relatively more sediment. Broenow and Breaker (2005) measured maximum tidal flow velocities at the UPRR bridge during one 6-hour ebb cycle to be 120 centimeter per second (cm/sec) (3.7 feet per second [ft/sec]), well above the range sufficient to mobilize sediments from mudflats and channels within the slough complex (0.8 to 1.5 ft/sec) (Sea Engineering 2006). Tidal flow velocities are partially dependent on the magnitude of the tidal prism: the smaller the tidal prism that moves through a given cross-section, the lower the flow velocities will be.

It is important to note that intertidal erosion within Parsons and Elkhorn Slough creates a positive feedback loop within the estuary. As more sediment erodes from the system, the tidal prism increases and in turn increases flow velocities and the potential for continued erosion. Channel cross-sections exist in equilibrium with flow velocities: narrow cross-sections scour with increasing flow velocities until it is large enough to slow flow velocities below scour thresholds. Scour thresholds are a function of sediment composition and morphology, which are discussed further in section 1.1.5, Geomorphology.

**Sea Level Rise**

Sea level rise due to climate change affects coastal areas including Elkhorn Slough. Over 100 years of tidal water level data collected at NOAA’s tide gauge in San Francisco indicate that the California coast has already experienced approximately 8 inches of sea level rise in the last century. In its latest report on from 2007, the International Panel on Climate Change (IPCC) describes a potential increase in mean sea level rise of 0.2 to 0.6 meter (0.6 to 2.0 feet) relative to the 1980-1999 baseline. More recent research indicates that the IPCC models may underestimate potential sea level rise, as measured sea level rise from 1993 to 2006 has outpaced the IPCC models (Rahmstorf et al. 2007). In addition, most climate-change models fail to account for sea level rise from the potentially significant amount of ice-melt that could be contributed by the Greenland and Antarctic ice sheets.

---

1 This range only applies to inorganic sediments such as muds, clays, and fine silts; the Sea Engineering report does not describe critical shear velocities for peats and unconsolidated organic material.
To address the uncertainties surrounding how climate change may affect the California coast, the California Climate Change Center released a report in 2009 entitled “The Impacts of Sea Level Rise on the California Coast.” This report describes newer sea level rise predictions for two mid-range IPCC scenarios based on six global climate models developed in the United States, Germany, Japan, and France. These newer predictions describe potential sea level rise along the California coast of approximately 0.4 meter (1.3 feet) by 2050 and 1.02 to 1.38 meters (3.3 to 4.5 feet) by 2100. Analysis of a more severe IPCC model predicted potential sea level rise of 1.46 meters (4.8 feet) by 2100.

Sea level rise would increase the frequency, magnitude, and duration of inundation within Elkhorn Slough habitats. It would increase tidal energy and tidal prisms within the system if sediment accretion on the existing marsh level is smaller than the rate of sea level rise. These changes would likely induce further net loss of sediment from the system and further loss of vegetated tidal marsh.

1.1.3 Watershed Inputs

Watershed Characteristics

The primary contributors of fresh water to the Parsons system are direct rainfall and runoff from the slough’s watershed. Parsons has a relatively small watershed that includes the ephemeral drainages of Paradise Valley, Long Valley, and other adjacent canyons. Long Valley is the largest of these drainages, with an estimated annual runoff contribution of 830 acre-feet and an estimated average discharge of 1.15 cubic feet per second (cfs) (Moffatt & Nichol 2008). Land uses in the Parsons watershed are primarily undeveloped grasslands, pastures for cattle grazing, cultivated row crops, and low- to medium-density rural development. Runoff from the Parsons watershed contributes a number of pollutants to the slough, including nutrients (primarily nitrogen and phosphorus) and pathogens, but it also contributes sediment to a sediment-starved system. The effects of this runoff on water quality within the slough are described more in section 1.1.4, Water Quality.

Surface Water Hydrology

Like most coastal California sites, Parsons Slough has a Mediterranean climate that features cool, rainy winters and springs, foggy summers, and warm falls. The slough averages 55.2 centimeters (21.7 inches) of rain annually with most precipitation falling between the months of October and May, though annual rainfall can be highly variable (Caffrey et al. 2002). Precipitation that falls within the Parsons Slough watershed drains from the uplands through ephemeral drainages into slough habitats, and eventually flows to Elkhorn Slough and Monterey Bay by tidal action. It is not known how much water is removed from tributaries to Parsons Slough by pumps and other diversions, but such diversions (if any exist) are likely to be small due to the tributaries’ ephemeral nature.
Groundwater Hydrology

Relatively little is known about groundwater within the Elkhorn basin. It has been suggested that groundwater contributions to slough hydrology have decreased as agricultural pumping operations in the basin have increased; the main evidence for this claim is the lack of artesian wells and seeps that were once common in the area (Caffrey et al. 2002, Moffatt & Nichol 2008). These claims are bolstered by increases in chloride concentrations in wells near Elkhorn Slough, as saline influence from the slough has progressed farther inland, potentially in response to increased groundwater pumping (MCWRA 2005).

1.1.4 Water Quality

Water quality within Parsons Slough changes in response to seasonal fluctuations in tides, watershed inputs, weather patterns, and other factors. The Elkhorn Slough Foundation (ESF) and ESNERR have implemented a number of water quality monitoring programs throughout the Parsons-Elkhorn Slough systems in order to understand the relationships between water quality and its driving physical and biochemical processes. These programs include:

- System-Wide Monitoring Program (SWMP): Continuous monitoring of temperature, salinity, DO, pH, turbidity, and water depth in a channel within South Marsh upstream of the UPRR bridge from January 1996 through the present day.
- Volunteer Program (Volunteer): Monthly spot-collections of these same parameters at two locations within the northeast portion of the Parsons system – one location within Whistlestop Lagoon, and another near the bridge connecting the Parsons system with a wetland near Rookery Lagoon. Data at these locations were collected from September 1989 through the present.
- Land/Ocean Biogeochemical Observatory Program (LOBO): Continuous monitoring of temperature, salinity, depth, DO, turbidity, nitrates, and chlorophyll at a station 0.5 meter below the water surface near the head of Parsons Slough in the “Five Fingers” area. This location (L05) was monitored from August 2006 through October 2007.

Water quality within Elkhorn and Parsons Sloughs is discussed in detail in numerous reports (Moffatt & Nichol 2008, Caffrey et al. 2002, PWA 2008). Overall trends and observations in six primary water quality parameters of management interest are summarized below.

Temperature

Temperatures in Parsons Slough demonstrate an expected seasonal pattern, with warmest temperatures (20-25 °C) in the late summer and fall, and coolest temperatures (5-10 °C) during the winter and early spring (ESNERR data in Moffatt & Nichol 2008). Temperatures in the slough also tend to follow strong diurnal patterns, with fluctuations of approximately 5 °C during warmer summer-fall months and less than 2 °C during cooler winter-spring months (Caffrey et al. 2002). Like many shallow estuaries, temperature stratification (warmer temperatures near the top of the water column, and
cooler temperatures near the bottom) most likely occurs during slack low tides in shallower (less than 1 meter deep) areas of the slough, especially in the summer. There are insufficient data to show evidence of thermal stratification within Parsons Slough due to a lack of instrumentation at multiple depths. Significant stratification is unlikely during the winter-spring months due to the mixing effects of watershed inputs and strong winds and rains from winter storms.

**Salinity**

Salinity in Parsons Slough also demonstrates a pattern that is responsive to seasonal and diurnal forcing mechanisms. Typically, salinity in Parsons Slough approximates that of Elkhorn Slough, at near-marine levels that average approximately 30 parts per thousand (ppt) (ocean salinity is typically about 35 ppt) (ESNERR data in Moffatt & Nichol 2008); however, salinity decreases in response to freshwater inputs from the watershed, and during particularly significant winter storm events can dip well below 20 ppt and even approach freshwater values (Moffatt & Nichol 2008). Salinity in more shallow areas (such as the SWMP monitoring site at South Marsh) typically increases during the day in response to temperature-driven evaporation. At high tides, these more saline waters mix with cooler, less saline waters from the mainstems of Elkhorn and Parsons Sloughs, causing a semi-diurnal increase in salinity that can be observed during both warm and cool months (Caffrey et al. 2002).

**Dissolved Oxygen**

Dissolved oxygen is one of the most critical water quality parameters because lack of adequate dissolved oxygen in the water column can adversely affect a broad range of aquatic and benthic wildlife on multiple trophic levels, including fish, sharks, rays, clams, oysters, crabs, and worms. DO can vary dramatically in response to estuarine and watershed flows, weather patterns, mixing and circulation patterns, and primary productivity within the water column. These variations can be seasonal, as in those driven by weather patterns and watershed flows, or diurnal, as those driven by estuarine flows and primary productivity. DO is usually expressed in terms of percent saturation (the amount of oxygen that is dissolved in the water, relative to the maximum amount that could be dissolved) or in absolute terms (usually milligrams of DO per liter of water [mg/L]). The maximum amount of oxygen that can be dissolved in water is temperature-dependent; oxygen is more soluble in cold water than in warm water. Typically, surface water achieves DO saturation at 10-12 mg/L. Most surface waters in Central California have average DO concentrations of 8-12 mg/L (CCAMP 2010). About 98 percent of coastal waters in California typically have DO levels above 5 mg/L (SWRCB 2006). Dissolved oxygen levels below 5 mg/L are typically deemed “hypoxic” (low oxygen) for aerobic organisms (fish, amphibians, etc.), while levels below 2 mg/L are considered “functionally anoxic” (most aquatic organisms would respond as if there were no oxygen).

Monitoring data from within Parsons Slough show that the system typically has DO levels within acceptable ranges, but periodic events can drive extreme increases or decreases in DO (Moffatt & Nichol 2008). Extreme increases in DO (up to DO supersaturation, or DO levels above 100 percent saturation) are usually induced by primary production in the water column or along the benthos – e.g., the oxygen
produced during the day through photosynthesis by phytoplankton, algae, and other submerged aquatic plants such as eelgrass. The SWMP, Volunteer, and LOBO data sets all contain frequent instances of DO supersaturation); these events do not seem to be limited to a particular seasonal set of conditions (Figure 6). It is possible that many of these events are tied to low-turbidity conditions, as photosynthesis is a light-dependent process. In times of algal blooms (sudden population increases driven by seasonal cycles), DO can increase to supersaturated levels during the day, and then suddenly crash to hypoxic or even anoxic levels once the sun sets and primary producers and microbes in the water column and benthos turn to respiration, which consumes DO in the water column. This diurnal signal has been observed in the historic LOBO data from Parsons Slough (Figure 7), though it should be noted that the DO swings observed at Parsons are far less extreme than those observed at poorly flushed sites like Azevedo Pond, a diked wetland farther up the main Elkhorn channel (Caffrey et al. 2002). Tidal flows can also influence DO concentrations on a semi-diurnal cycle by transporting high-DO water from Monterey Bay into the slough on a flood tide, and removing lower-DO water from the slough into Elkhorn Slough and eventually the Bay on an ebb tide.

In Parsons Slough, severe low DO events are frequent during the summer and early fall, when nighttime DO crashes become cumulatively worse as the system accumulates both respiring algae and decomposing organic material due to summertime productivity (Figure 6). Sudden decreases in DO can also occur when there is turbulence in the water column that re-suspends organic material with high biological oxygen demand (BOD) from the benthos and causes a corresponding decrease in DO.

DO levels in estuaries such as Parsons Slough are strongly influenced by the development of eutrophic conditions. Eutrophication is generally defined as the enrichment of a water body with nutrients. These nutrients induce rapid growth of phytoplankton and other primary producers that cannot be sustained. When the primary producers die, their decomposition consumes significant quantities of DO within the water column. While this phenomenon is not uncommon in estuaries, which tend to act as “sinks” for nutrients within watersheds, it can be exacerbated by land use practices such as irrigated/fertilized agriculture and grazing. Water quality data collected by ESNERR indicates that eutrophication in Elkhorn Slough is a concern, especially in tidally restricted areas such as Azevedo Pond. In its recent updates to the Clean Water Act (CWA) 303(d) list of impaired water bodies, the Central Coast Regional Water Quality Control Board (RWQCB) has recommended listing Elkhorn Slough (including Parsons Slough) as impaired for low DO, a decision supported by ESNERR scientists (ESNERR 2009).

Currently, extensive beds of sea lettuce (Ulva spp., also known by the outdated taxon Enteromorpha) are present floating and on mudflats throughout the slough (Figure 8). These algae beds constitute a major source of highly labile organic material (material subject to aerobic decomposition) within Parsons Slough, and may also impact the persistence of eelgrass beds within the system (ESNERR 2009). When algae and other organic material decompose in the slough, flushing action within the slough system generally prevents the development of severely hypoxic and anoxic waters (with the exception of the tidally restricted areas described above). In these areas of poor tidal circulation, resultant increases in hydraulic residence times exacerbate eutrophication and attendant low DO levels by prolonging the period of time that water is in contact with high-BOD bottom sediments. This lowers DO levels in the water column at these locations even further. Under periods of exceptionally poor circulation, bottom
waters can become anoxic, which can induce the release of nutrients such as ammonium (NH₄⁺) and orthophosphate (PO₄³⁻) from the benthos in a process called “internal nutrient loading.” Such loading can induce a positive-feedback loop that further exacerbates eutrophication and lowers DO levels throughout the water column.

**Nutrients**

The primary inorganic nutrients of interest within Parsons Slough are nitrogen and phosphorus. Both are necessary for the growth of algae and other plants, and as such are important components of a productive marsh food web; however, in quantities above those found under “natural” (un-anthropogenically altered) conditions, these same nutrients can negatively impact water quality and ecosystem health within the slough. As mentioned earlier, high levels of nutrients can induce the formation of eutrophic estuarine conditions, which can decrease DO levels, impact sediment quality, and limit habitat suitability for aquatic organisms. The primary source of external nutrients to the Parsons-Elkhorn Slough system is runoff from the system’s watershed, especially from agricultural operations (e.g., fertilizers, manure); relatively smaller inputs include sources from tidal pumping, atmospheric deposition, and bacterial fixation (Caffrey et al. 2002).

Nitrogen and phosphorus are present in estuarine environments in many forms. Organic nitrogen and phosphorus refer to nutrients that are incorporated into carbon-based material – in other words, material that is or once was part of a living organism. Inorganic nutrients are purely mineral forms of nutrients such as nitrate (NO₃⁻), nitrite (NO₂⁻), ammonium (NH₄⁺), and orthophosphate (PO₄³⁻). It is important to note that within an estuary both nutrients cycle through a variety of forms that are dependent upon bacterial action, oxygen availability, and other environmental conditions. While both inorganic and organic nutrients are soluble in water, the soluble inorganic fraction is most frequently used to describe potential impacts to water quality. Discussions of nutrients as they relate to water quality in this analysis primarily discuss concentrations of inorganic nutrients.

Nutrient levels, and particularly nitrate levels, throughout the entire Elkhorn Slough system have increased dramatically over the past 60 years, primarily in response to increases in the proportion of agricultural land within the slough’s watershed (Caffrey et al. 2002). Nitrate levels in Elkhorn Slough, which were once within the range of those measured within Monterey Bay, are now among the highest of any monitored coastal estuary reported in scientific literature. Nitrate-nitrite levels exceeding 3000 µM² and phosphate levels of up to 50 µM have been measured within the slough; these concentrations are orders of magnitude higher than those commonly encountered in San Francisco Bay or Tomales Bay (Caffrey et al. 2002). To address these elevated nutrient levels, ESNERR scientists have requested that Elkhorn Slough be listed as a CWA 303(d) impaired water body for nitrate, ammonia, and phosphate. However, observed nitrate levels within Parsons Slough have tended to be lower than those in Elkhorn

---

² Micromolar (µM) is a term commonly used to describe concentrations in a solution. A solution with a molarity of one M contains one mole of a compound in one liter of solution. A solution with a molarity of one µM contains 10⁻⁶ moles of a compound in one liter of solution.
Slough (Figure 9), most likely due to system’s relatively smaller watershed with less intensive agricultural development (Moffatt & Nichol 2008).

Runoff from the surrounding watershed is the primary source of nutrients to the Parsons Slough system (Caffrey et al. 2002). Inorganic nitrate concentrations in Parsons Slough peak during the spring, when storm events transport sediment and associated nitrogen loads from the watershed into the basin (Figure 9). These concentrations then decrease throughout the summer as inputs decrease and the nitrate is converted to organic nitrogen and other inorganic forms of nitrogen (Caffrey et al. 2002). Phosphorus levels within the Parsons Slough Complex appear to be moderate compared to levels within the greater Elkhorn Slough system, which can be quite high (Hughes et al. 2010). Approximately 90 percent of the phosphorus within Elkhorn Slough is in a dissolved, inorganic form (Caffrey et al. 1997), and phosphate flux between the benthos and the water column is low and not directly related to primary productivity or diffusion across the sediment-water interface (Caffrey 1996). Caffrey (1996) studied biogeochemical cycling of nitrogen and phosphorus between the benthos and the water column throughout the Elkhorn Slough system from 1994-1995. This study, summarized in Caffrey et al. (2002), included two water quality sampling stations (at South Marsh and the Reserve Bridge) and one benthic flux station (at Five Fingers) within the Parsons complex. In general, the Five Fingers station had lower rates of sediment oxygen consumption than most other sites within the Elkhorn system, indicating that the benthos within Parsons Slough is relatively less enriched with organic matter than other slough habitats. The Five Fingers site also had the highest rates of potential nitrification, indicating that oxygen is not a limiting factor for nitrogen cycling at this location.

Finally, concentrations of nitrogen and phosphorus with the slough system can exhibit diurnal or semi-diurnal patterns: both nutrients are taken up by primary producers during the day, and tidal flushing can dilute slough water with water from Monterey Bay, which contains relatively lower levels of nutrients (Caffrey et al. 2002).

**Turbidity and Suspended Sediment**

Turbidity is a measure of the amount of material suspended in the water column, and is a commonly measured water quality constituent along with temperature and salinity. In tidal systems, turbidity monitoring can often help indicate the relative amounts of sediment that are entering a site on flood tides and leaving on ebb tides. Turbidity can also be an indicator of other water quality constituents, such as primary productivity (since the presence of free-floating algae can increase turbidity), and/or BOD within the water column (as organic particles are often a substantial contributor to turbidity). Turbidity is typically reported in Nephelometric Turbidity Units (NTU), a measure of how much light is scattered when a beam of light called a nephelometer shines through water. In Parsons Slough, turbidity has been monitored through both the Volunteer and SWMP programs.

In Parsons Slough, turbidity appears to be primarily controlled by weather events, though algae production may contribute to late-summer/early fall turbidity spikes. Large storms wash sediment-laden runoff into the slough, and high winds can re-suspend settled sediments. Examples of storm-induced turbidity in Parsons Slough can be seen in the data from 1997-2000, illustrating a clear spike in
turbidity from the winter 1997-1998 storms as well as a potential algae bloom in August 1998 (Figure 10).

**Contaminants**

A recent history of intense land use within the Elkhorn Slough watershed and along the slough’s mouth has increased the amounts and types of contaminants in slough waters. These contaminants can cause both short-term and long-term impacts to the survival, growth, and reproduction of biological communities within and around the slough. Most contaminants within the slough system fall into one of three categories: pesticides, microbial contaminants (pathogens), and contaminants associated with harbor operations (Caffrey et al. 2002). Elkhorn Slough is a CWA 303(d) listed waterbody for pathogens and pesticides (CCRWQCB 2006). These contaminants are discussed in greater detail below.

**Pesticides.** Pesticides are broadly used in agriculture to kill a wide variety of insect pests. There are two primary categories of pesticide type: chemical pesticides, which include organophosphate, carbamate, organochlorine, and pyrethroid compounds, and biopesticides, which include microbial, plant-incorporated protectant (PIP), and biochemical compounds (EPA 2009). Most conventional pesticides are chemical pesticides. Although the use of many organochlorine pesticides (such as DDT, chlordane, and toxaphene) has been banned by the EPA, these contaminants are highly persistent in the environment and can still be detected in soils around Elkhorn Slough (Blankinship and Evans 1993, Werner et al. 1997 in Caffrey et al. 2002). Some chemical pesticides, such as atrazine, can have morphological impacts on biota at concentrations as small as 1 part per billion (ppb) (Hayes et al. 2003), while others, such as the afore-mentioned DDT, can bioaccumulate, magnifying the impacts of contamination well up into the food chain (Caffrey et al. 2002).

Within the Parsons watershed, commercial agriculture is the largest contributor of pesticides to the environment, though residential use likely contributes a much smaller fraction (Caffrey et al. 2002). Although there have been multiple studies of toxic contaminants throughout Elkhorn Slough (see Caffrey et al. 2002 for a useful bibliography), only the California State Mussel Watch Program (CSMWP) has monitored contaminants within Parsons Slough itself. The CSMWP monitored concentrations of toxins within mussels in the bed of the main Parsons Slough channel at a location 800 feet downstream of the UPRR bridge annually from 1982 through 1989 (with the exception of 1984) and again in 1993. Data from the CSMWP describing concentrations of total DDT, total chlordane, and toxaphene\(^3\) levels in parts per billion of grams (ppb/g) of lipid weight\(^4\) are presented in Figure 11. While ecological health standards for organochlorine concentrations have not been established within Elkhorn Slough, a similar mussel monitoring program in coastal Massachusetts set “caution levels” of 205 ppb/g lipid weight for chlordane, and 483 ppb/g lipid weight for DDT (Werme and Hunt 2002). In the CSMWP dataset, levels

---

\(^3\) DDT and chlordane have multiple chemical forms; the use of the word “total” indicates that the data describe the sum of their respective different forms.

\(^4\) Organochlorine pesticides bioaccumulate in organisms because they are highly lipophilic. Therefore, organochlorine concentrations in tissue samples are often presented in ppb wet weight, dry weight, and lipid weight. The latter is being increasingly used as monitoring standard in water quality management programs.
of total chlordane remained fairly constant throughout the sampling period, while levels of total DDT and toxaphene varied dramatically. All of the CSMWP samples exceeded the Massachusetts standards, indicating that the persistence of these pollutants was and is likely to remain a concern within the Parsons-Elkhorn Slough systems.

The forces governing contaminant dynamics within the Parsons system are poorly understood, but anecdotal evidence may shed some light on these pollutants. In 1995, multiple organochlorines were linked to the sudden collapse of a nesting colony of Caspian Terns (*Sterna caspia*) within South Marsh. Research by ESNERR scientists indicated that levels of DDE (a metabolite of DDT), toxaphene, and PCBs (polychlorinated biphenyls, a common industrial pollutant) in eggshells and the bodies of dead birds were much higher in 1995 than in samples collected in 1994. The scientists came to the preliminary conclusion that the 1995 flooding of the Pajaro River transported contaminated sediments from the Pajaro agricultural basin into Elkhorn Slough; the subsequent movement of these contaminants into the food chain was likely what led to the failure of the nesting colony (ESNERR 2008).

Since the banning of many of the most persistent pesticides in the 1970s, the potential movement of newer, acutely toxic yet rapidly-degrading agricultural chemicals from the Parsons Slough watershed into the basin is poorly understood. In order to assess which newer pesticides might cause adverse impacts within the Elkhorn Slough basin, in 1992, NOAA initiated a Hazard Rating Coefficient (HRC) analysis for the slough. The HRC analysis considered fish and crustacean toxicity, bioconcentration factors, and soil half-life, assigned an HRC to each pesticide, and then multiplied each HRC by the quantity of the pesticide used in the Elkhorn watershed at the time. The analysis indicated that the newer pesticides of concern within the watershed are methamsodium, thiram, dicofol, malathion, and chlorpyrifos (Caffrey et al. 2002). Current application rates of these chemicals within the Parsons watershed are unknown.

**Pathogens.** There are two primary pathogens of concern within the Parsons-Elkhorn system: coliform bacteria, and *Toxoplasma gondii*, a parasitic protozoa. Coliform bacteria live in the intestines of humans and other warm-blooded animals, and their presence in the water column is usually indicative of contamination by fecal material. Fecal material can carry a broad range of other dangerous pathogens, but many of them are relatively less dense and more difficult to detect than coliforms. For these reasons, coliform counts are often used as monitoring surrogates for fecal pathogens. Within the Elkhorn Slough system, contamination by coliform bacteria has been a known problem since the 1960s (ABA Consultants 1986). A 1985 study of coliforms throughout Elkhorn Slough found that most coliforms in the system were not human, and that levels were highest in areas with freshwater inputs (ABA Consultants 1986). The latter was confirmed by another study in 1994 and 1995 that also found only moderate coliform levels near harbor seal haul-out sites and dairies (Young 1996). Little to no information exists describing coliform concentration and distribution patterns throughout Parsons Slough, but it stands to reason that these patterns would approximate those of Elkhorn Slough.

*Toxoplasma gondii* is a pathogen of humans and terrestrial animals that is best known for inducing toxoplasmosis in pregnant women. While many mammals are capable of hosting *T. gondii*, only domestic cats are known to shed oocysts that can then be transported via storm runoff into water bodies. Recent studies along the California coast have indicated that *T. gondii* is having a particularly
lethal effect on California sea otter populations. For example, 16 percent of fresh, beachcast otter carcasses collected along the California coast between 1998 and 2002 had deaths attributable to *T. gondii* infection (Miller et al. 2004). A 2002 study reported *T. gondii* infection rates of 42 percent in live otters and 62 percent in dead otters (Miller et al. 2002). This same study described Elkhorn Slough and its environs as an epicenter for infection; 79 percent of the otters in the area tested positive for *T. gondii*, and otters within 10 kilometers of the slough were 1.5 times more likely to be infected. Miller and her colleagues performed a series of analyses to conclude that the primary reason for the high infection rate within Elkhorn Slough is the high levels of exposure to freshwater flow from the Elkhorn Slough watershed. The marine source of *T. gondii* exposure to sea otters is not well understood, and it is not clear how the parasite travels from the water column into otters, though otters’ consumption of filter feeders such as clams and oysters is strongly suspected (Miller et al. 2002). Within the Elkhorn Slough watershed, both domestic and feral cats are likely sources of *T. gondii* (Miller et al. 2002). Among all cats in Monterey County, domestic cats are thought to contribute 78 percent of the outdoor fecal load, while the other 28 percent is contributed by feral cats (MRSWMP 2007). It is likely that the Parsons Slough watershed contains both domestic and feral cats, and that runoff from the Parsons watershed contributes to the prevalence of *T. gondii* throughout Elkhorn Slough. The Monterey Regional Storm Water Management Program (MRSWMP) has implemented a program to identify and reduce sources of *T. gondii* infection within the County, including the Elkhorn/Parsons Slough watersheds (MRSWMP 2007). This program is primarily focused on addressing the behaviors of cat owners that lead to *T. gondii* release; meanwhile, research programs at UC Davis and other institutions are currently researching the epidemiological links between Elkhorn Slough’s watershed and local sea otter infections (USDA 2010).

**Contaminants Associated with Harbor Operations.** This category includes a broad range of contaminants including heavy metals (lead, copper, etc.), polycyclic aromatic hydrocarbons (PAHs), PCBs, and other industrial chemicals associated with harbor operations and maintenance. While the distribution of these chemicals within Parsons Slough is poorly understood, many of these compounds, such as copper and tributyltin (TBT), are used as anti-fouling agents on boats and boat accessories. Copper is a well-known inhibitor of phytoplankton growth and reproduction (Thomas and Robinson 1986), and is commonly used on boats to prevent the attached growth of filamentous algae and other organisms. TBT is an endocrine disruptor that can induce malformation of reproductive organs in gastropods such as snails and sea slugs (Bryan et al. 1987, Waite et al. 1991 in Caffrey et al. 2002). Isolated areas of Moss Landing Harbor have been known to contain relatively high TBT sediment levels of up to 70 ppb dry weight, whereas the California Bay Protection and Toxic Cleanup Program (BPTCB) has recorded a maximum of 6.21 ppb of TBT (Caffrey et al. 2002). Both TBT and heavy metals are well known for their abilities to bioaccumulate throughout the aquatic food chain. Pressure-treated pilings such as those within Moss Landing Harbor contain creosote, which is a source of PAHs; however, low PAH levels within Elkhorn Slough sediments indicate that PAH contamination may not be a significant problem within the system (Caffrey et al. 2002). Many of these contaminants (along with their agricultural peers) have a tendency to accumulate in the benthos; therefore, dredging activities within the harbors at the Elkhorn Slough mouth can have a significant influence on the availability of these contaminants throughout the Elkhorn Slough system (Caffrey et al. 2002). The distribution of these...
compounds throughout the Parsons Slough system is unknown, but due to tidal circulation patterns it can be assumed they are present.

1.1.5 Geomorphology

The geomorphology of Parsons Slough can be broken up into three categories: (1) salt marsh, between the upland-wetland edge and mean high water (MHW), (2) intertidal mudflats between MHW and MLLW, and (3) subtidal habitats below MLLW (Ducks Unlimited et al. 2010; Gentzler pers. comm.). These three categories, their distributions, and factors affecting their distribution are described below.

Salt Marsh

Due to the land use history described in section 1.1.1, Geographic Setting and Land Use History, salt marsh is the least common habitat within Parsons Slough. Most of the site (approximately 95 percent) has or is subsided to elevations below MHW (+4.77 feet above the North American Vertical Datum of 1988 [NAVD]), leaving only 21 acres of tidal marsh. Almost all of this marsh is limited to fringing marsh along higher portions of the wetland-upland edge, and areas within the 1980s South Marsh wetland enhancement area. Unlike other tidal salt marsh systems in California, such as the salt marshes of San Francisco Bay, there is no low marsh (below mean tide level) community dominated by species such as cordgrass (Spartina spp.). Therefore, all salt marsh within Parsons Slough is high marsh, dominated by perennial and annual pickleweed (Sarcocornia spp.).

As in many places, fringing tidal marsh within Parsons Slough has little to no channel development, and exists in only a narrow (typically less than 10 ft wide) band around the slough margins. The limited tidal marsh within South Marsh exists in isolated, somewhat hummocky rectilinear islands that also contain few to no channels.

The small amount of tidal marsh that remains in Parsons Slough is being rapidly transitioned into intertidal mudflats by tidal erosion. The system simply cannot accrete enough suspended sediment (or create enough of its own organic peat) to maintain suitable tidal marsh elevations in a sediment-starved environment subject to rising sea levels and increased levels of tidal energy.

Intertidal Mudflats

The same processes that have led to the relative lack of tidal marsh within Parsons Slough have resulted in a relative abundance of intertidal mudflat. Almost 83 percent of the site is within the elevation range for intertidal mudflat (between MLLW and MHW, or +0.44 and +4.77 feet NAVD), resulting in 363 acres of intertidal mudflat. Intertidal mudflats exist throughout the entire Parsons Slough system, primarily in areas that were once tidal marsh but have since subsided to intertidal elevations. Mudflats within the portion of the slough that is south of South Marsh and west of the Five Fingers tend to have well-developed networks of inter- and subtidal channels that flood and drain the mudflats. Relict channel networks are less common in South Marsh, where they were completely obliterated by reclamation for
agriculture between 1949 and 1980. Mudflats within the Five Fingers have relatively simple channel networks due to the narrow shape of the finger canyons and the predominantly subtidal nature of this area.

In certain areas, especially the former diked pastures of western Parsons Slough, mudflats that are distal from tidal sources have lower elevations than mudflats that are adjacent to tidal channels. This is primarily due to sediment oxidation patterns when the former tidal marsh soils were diked and drained. Marsh sediments adjacent to channels tend to have relatively greater proportions of mineral sediment (due to tidal deposition) than sediments within the interior of the marsh plain, which are composed of proportionally greater fractions of organic material. When these soils are diked and drained, interior wetland areas with more organic sediment tend to subside more than areas along channels with higher mineral content. This differential subsidence creates a “bathtub” effect that can persist well after the soils have been disturbed and is visible in aerial photographs.

Many intertidal mudflats within Parsons Slough contain attached beds of macroalgae such as the Ulva and Enteromorpha species described above. While the presence of this algae has serious implications for water quality (see section 1.1.4, Water Quality), in some locations it may be one of the few factors helping mudflat sediments to stay in place instead of being transported out of the slough system on an ebb tide.

**Subtidal Habitats**

Subtidal habitats include 56 acres of channels and submerged mudflats below MLLW (+0.44 feet NAVD). These habitats compose 13 percent of the aquatic habitats within Parsons Slough and are primarily found within the system’s main tidal channel. While many of the existing subtidal areas have likely been that way for quite a while (existing channel locations commonly coincide with historic channel locations), the main flood/ebb channel within Parsons has deepened over time as the increasing tidal prism induced incision and downcutting within the channel (Moffatt & Nichol 2008).
References

Personal Communications

Gentzler, S., Hydrology and Hydraulics Group Manager. 2010. Email correspondence between Gentzler, URS Corporation, and April Zohn, Lux Environmental Consulting, regarding updated tidal prism and habitat estimates (Tables 7-1 and 7-2 in Ducks Unlimited et al. 2010) based on revised tidal datums. March 2.

VanDyke, E., GIS Specialist. 2009. Email communication between VanDyke, ESNERR, and Christina Toms, Wetlands and Water Resources. December.

Literature Cited


Figures
Figure 2. Elkhorn Slough is the most headward portion of the Monterey Canyon, a dominant feature along the Monterey Bay seafloor. Source: Google Earth, 2010.

Figure 3. A portion of the 1854 Coast and Geodetic Survey map of Elkhorn Slough the earliest known map of the area. Source: ESNERR.
Figure 4. Aerial photograph from August 1946, during construction of Moss Landing Harbor. The original, tidally choked outlet of Elkhorn Slough can be seen in the left-hand side of the photograph. This photograph also illustrates the considerable amounts of sediment exported from the system when it is open to Monterey Bay, as seen in the sediment flume emanating from the outlet. Photo from ESNERR.

Figure 5. The area currently known as “South Marsh”, as it appeared in the late 1940s when it was converted to dairy pasture. Source: ESNERR.
Figure 6. 2006 dissolved oxygen saturation data from South Marsh within Parsons Slough demonstrate multiple instances of DO supersaturation throughout the year, while severe low DO events are common throughout the summer and early fall. Source: SWMP data from the NERR Centralized Data Management Office.

Figure 7. Dissolved oxygen saturation at South Marsh within Parsons Slough demonstrates a diurnal signal in October of 2006. Source: Data from MBARI LOBOVIZ program.
Figure 8. *Ulva* mats within Elkhorn Slough. Source: SIMoN website, www.sanctuarysimon.org.

Figure 9. Nitrate concentrations measured at South Marsh by the LOBO system in 2006-2007. Source: MBARI LOBOVIZ program
**Figure 10.** Turbidity data from South Marsh, 1997-2000. Data gaps indicate periods of sensor malfunction. Source: ESNERR.

**Figure 11.** Concentrations of three banned organochlorine pesticides in mussels from Parsons Slough. Source: CSMWP.