# ELKHORN SLOUGH RESTORATION

# POLICY AND ECONOMICS REPORT


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NATIONAL OCEAN ECONOMICS PROGRAM

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**Elkhorn Slough Foundation**

This report integrates both policy and economic analyses of estuary restoration for Elkhorn Slough. This integration provides a more complete picture of the policy and economic impacts associated with four proposed restoration alternatives for Elkhorn Slough, proposed by Philip Williams & Associates Ltd. (PWA).

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The National Ocean Economics Program (NOEP) provides a full range of the most current economic and socio-economic information available on changes and trends along the U.S. coast and in coastal waters. The program is funded by federal, state, university, and private grants and contracts.

The mission of NOEP is to link the nature, scope, and value of human activities to the environmental state of the coast and coastal oceans.

The NOEP research program compiles information about economic, political, and social patterns in the coast and coastal oceans. Researchers, primarily economists, policy analysts, and computers scientists, identify, collect, and formulate primary and secondary source information, then analyze and interpret it.

The Coastal Ocean Values Center (COVC) focuses on collecting and analyzing data to meet the needs of coastal managers, stakeholders and advocates. COVC research includes a program to develop a national set of economic indicators of coastal health, the development of surveys to assess and monitor private coastal uses and users, valuation studies of critical marine and coastal resources

The Mission of COVC is to create a national program of coordinated research and data collection on economic indicators of coastal ecosystem health; educate the public and coastal managers about the economic importance of coastal activities; and provide economic data and analysis to improve coastal and ocean management.


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# Preface

The *Elkhorn Slough Restoration: Policy & Economic Report* presents a compilation of data, statistics, and qualitative information that integrates policy and economics to guide estuary managers. This study is currently held up as a model for Ecosystem-Based Management because it informs decision-makers by incorporating policy and economics considerations into science and engineering information. This report describes and interprets the possible effects of two major aspects from restoration options 1) regulatory and policy implications and 2) economic impacts. This includes policy and economic analysis of four restoration alternatives. The policy analysis is based on potential impacts to the natural and man-made systems and the associated legal and regulatory considerations. Economic indicators estimate the Elkhorn Slough's effect on the local economy including potential impacts to the harbor, commercial and recreational fishing, tourism and nature recreation, beach going, and power generation.

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# Executive Summary

The rapid transition from salt marsh to mudflats in the Elkhorn Slough, in large part the result of a large tidal prism caused by a number of natural and human induced changes over the years, has catalyzed a major research effort over the past several years to determine the best course of action that might stabilize the situation and provide a support system to sustain the biodiversity and rich assets of this unique estuary. This report is the result of the work of the socioeconomic/policy team, a part of the Ecosystem-Based Management (EBM) research team, which is part of the Elkhorn Slough Tidal Wetland Project. The purpose of the larger project is to restore Elkhorn Slough to a smaller tidal prism so that erosion creating mudflats out of salt marsh can be halted to allow return of some of the salt marsh that has been inundated without affecting the chemical balances which are already characterized by nutrient overload. Four restoration options, and combinations of these four, have been analyzed and offered by hydrologists. The EBM team members were contracted to determine which option would be the most effective in carrying out this goal. The nature and scale of three of the restoration options, pose the possibility of impacts to local businesses, endangered and threatened species, special biological areas, and water quality. These possible impacts could raise questions related to environmental compliance or local business revenues, causing political opposition that could entail actions required by a variety of laws and regulations.

This EBM effort was funded as a model to determine whether and how multiple disciplines, including social science, could and should be brought into the decision equation that traditionally have been left to scientific and engineering considerations. Including social sciences—policy and economics—provides an extra challenge but, if done carefully, should avoid the pitfalls of restoration projects that were undermined by external political decisions, unexpected complications with stakeholders, funding, or snafus in the permitting and permissions process. In the case of Elkhorn Slough, active interests are found at many levels of the process including local and national business, academic and environmental interests, and all levels of government.

A thorough investigation revealed an array of governmental and non-governmental groups that have some authority or interest in what happens to the Elkhorn Slough, and list of laws and regulations they oversee. Three case studies provide lessons learned, which are applicable to this project.

Economic research shows that changes in the Slough could cause changes in the local economy based on four indicators: habitat change, locale connectivity, changes in sediment, delivery, erosion, and accretion; and changes in water quality.

One of the most significant policy issues that emerged was the absence of an identifiable entity for legal oversight and accountability for the entire area under consideration, should a restoration option involving the whole system be desired. With multiple land owners and regulators for different boundaries and none for the entire system, the question of who has the authority to sign off for restoration options is critical. Whether it is necessary to create a new entity, such as a "special district" or use a Memorandum of Understanding among relevant bodies, remains a question.

Potential environmental impacts from changes associated with environmental laws and regulations warrant at least two types of consideration: 1) to ensure the Slough is compliant with relevant laws and regulations and to keep the relevant agencies informed in a timely fashion; and 2) be aware of possible challenges from interests that might be affected or who may be harmed in some way by proposed activities. Therefore, careful planning, inclusion of all stakeholders, and process transparency were considered essential steps in carrying out any of the proposed options. In addition, contingencies for mitigation measures will be essential to address potential regulatory, policy, and /or legal concerns.

The economic findings from the study indicate that the environmental condition of the Slough could have identifiable impacts on the local economy and on those visiting the Slough and should be weighed accordingly when making final restoration option decisions. Preliminary results indicated that an increase in the number of days of hypoxia (days in which oxygen levels are low) in the Slough could have an impact on fish stocks that use the Slough as a nursery. There were also linkages between the need to dredge the harbor and the amount of sediment entering and exiting the Slough. Findings such as these examples indicate that changing the tidal prism could affect stakeholders in a variety of ways.

Restoration projects can ultimately fail if costs and difficulties are not clearly defined and anticipated. Sometimes it is best to implement a restoration incrementally, as was done in two of the cases analyzed for this report, if total project implementation difficulties seem insurmountable. Timing is one of the most critical variables for successful implementation of restoration projects. This includes coordinated timing of funding and permits, and early involvement of affected groups/stakeholders and government agencies with predetermined outreach sessions to keep them informed.

# 1 Introduction and Background

The National Ocean Economics Program (NOEP) was contracted to provide both economic and policy analyses of the proposed restoration alternatives for the Elkhorn Slough. The economic portion was conducted by the Coastal Ocean Values Center under a subcontract and led by Senior Fellow of the Ocean Foundation, Dr. Linwood Pendleton. The policy part of this report was conducted by the NOEP research team, led by Dr. Judith T. Kildow, Senior Social Scientist at the Monterey Bay Aquarium Research Institute.

This report is a compilation of quantitative evidence and qualitative information used to assess and interpret policy and economic considerations to guide estuary managers as they assess which options to restore the Slough to former conditions when it was more salt marsh. This particular effort is currently one of several studies considered models using an Ecosystem-Based Management strategy (EBM) with the purpose to incorporate policy and economic considerations into science and engineering information as a way to inform decision makers. Including social sciences—policy and economics—provides an extra challenge but, if done carefully, should avoid the pitfalls of restoration projects that were undermined by external political decisions, unexpected complications with stakeholders, funding, or snafus in the permitting and permissions process. In the case of Elkhorn Slough, active interests are found at many levels of the process including local and national business, academic and environmental interests, and all levels of government.

This report describes and interprets the possible impacts on policy and economics of four restoration options. The policy analysis is based on potential impacts to the natural and man-made systems with the associated legal and regulatory compliance considerations. Economic indicators linked to natural system changes estimate the Elkhorn Slough's effect on the local economy including potential impacts to the harbor, commercial and recreational fishing, tourism and nature recreation, beach going, and power generation.

The economic sections provide two perspectives for restoration options: 1) the current economic profile of the Slough itself regarding number of visitors, why they visit and approximately how much they spend when they visit; and 2) linkages between environmental characteristics, (e.g. water quality and sediment loss) of the Slough and their value to those local businesses for which financial information was available.

The first perspective is based on surveys of Slough visitors and past data on attendance at the Elkhorn Slough. The second is the result of extensive data collection of fisheries, water quality, sediment transport and other environmental data compiled by other members of the EBM team and integrated into the economic effort. It also included extensive data collection from local businesses and the harbormaster that helped provide the linkages between the local economics and environmental assets and services.

The policy sections of the report details the policy implications and legal and regulatory processes associated with restoration activities using:

1. Charts of the political and jurisdictional agencies that ultimately influence the outcomes of the decisions.

2. Lists of potential legal, political, and regulatory considerations for project feasibility.
3. Relevant case-studies with lessons learned from estuary restoration projects along California's coast that can be applied to the policy and decision-making process for Elkhorn Slough.
4. An analysis of the links between restoration options, and legal and regulatory compliance with indications of degree of difficulties that may be encountered.

The importance of stakeholder engagement, knowledge of the political dynamics, and understanding of the regulatory requirements necessary to undertake activities for a project should improve outcomes by better informing decision-makers about what challenges they face. The purpose of integrating the political process into the EBM framework is to incorporate human dimensions that influence outcomes because they rely on the natural resources and landscape affected by possible decision. Analyzing human linkages to natural systems and to those political systems that govern the management of natural resources can help to predict outcomes and inform a more effective course of action that people are likely to support.

For the Elkhorn Slough restoration options, understanding the political dynamics is important to help project implementation, understand the policy processes and challenges that accompany the actions associated with the restoration proposals, identify opposition, and to guide project managers through potential regulatory and stakeholder networks and barriers.

The policy analysis relied on extensive legal research, surveys, case-studies, and stakeholder interviews, as well as continual interaction with the natural scientists and engineers working on this project. It contains case reports and formalized evidence and testimony by local and regional experts, scientists, and business professionals. Thus, the information is intended to inform decision-makers of public policy impacts and serve as an invitation to more rigorous scientific study of the policy implications in question. Rather than statistical information, this report provides the Elkhorn Slough management team with anecdotal evidence that improves the understanding of the costs and benefits of the proposed alternatives, and therefore should strengthen the justification for the final restoration decision.

# 2 An inventory of the Marine and Coastal Economy of Elkhorn Slough

[1]The Elkhorn Slough estuary ecosystem has changed dramatically over time, largely as a result of a variety of economic activities including agriculture, the railroad, harbor activity, and a power plant that uses waters from the Slough for its once-through cooling process. Each of these activities has, in some way, altered the hydraulics, sediments, habitat, and pollutants that affect the many plants, invertebrates, fish, birds, and mammals that reside in the Slough. At the same time, a new economy has grown up around this dynamic and changing ecosystem.

While agriculture, the railroad, and the power plant continue to influence the ecology of the Slough, the nature of the Slough itself influences the desirability of Moss Landing as a pleasure boat and fishing harbor. It affects the productivity of the nearshore fishery and draws tens of thousands of tourists and day users who come to the Slough to hike, walk, fish, and watch birds, otters, and other marine and estuary creatures. The dynamic Slough serves as an excellent natural laboratory and the safe harbor of Moss Landing is only meters away from one of the world's most studied marine canyons. Moss Landing supports research centers, provides a port adjacent to a famously productive fishery, and is home to a National Estuarine Research Reserve. Even the power plant, oft cited as a source of harm to the Slough, benefits directly from the environmental and ecological condition of the Slough – the plant requires cool clean water without which it would have to resort to far more expensive cooling procedures. All of these activities, in turn, support local restaurants and stores and provide a source of employment and taxes for the area. Finally, the Slough and its surrounding environs now increasingly serve as an aesthetic draw for home owners who continue to move within the Slough's view shed.

### *Economic Impact versus Economic Value in Coastal Economies*

When discussing the economy of coastal areas and working waterfronts, the discussion understandably starts with revenues, jobs, and taxes–things that keep the local economy running. To date, state and federal agencies have done a pretty good job accounting for the contribution of commercial fisheries to these three areas which collectively contribute to the *economic impact* of an activity.

Economic impact, however, is quite different from economic value. Unlike economic activity measures, measures of economic value attempt to capture the value of an activity beyond the costs of providing that activity. For businesses, that may correspond to net profits. For instance, a commercial fishery that grosses $2 million annually but has operating and capital costs of $1 million has an *economic value* of a $1 million. Another key difference between impact and value is that value accrues not only to the business owner through profits, but also to the consumer through a mechanism known as consumer surplus. Simply put, consumer surplus represents how much a consumer would have been willing to pay to enjoy something beyond what they have to pay - the larger the consumer surplus, the larger the economic value. Consumer surplus is why people are happy when they get something they want on sale. Their willingness to pay for the

[1] Linwood Pendleton, Allison Chan, Scott Norris, Judy Kildow, and Kerstin Wasson contributed to this section.

item stayed the same, but what they actually paid was less—in other words, they enjoyed a larger consumer surplus.

Economic impact and economic value do not go hand in hand. For instance, some businesses have high gross revenues and low profits. Some businesses contribute to economic value by generating revenues AND by generating consumer surplus for local consumers. When commercial fishers sell their products locally, they generate both profits and local consumer surplus. When fishers export their catch, the consumer surplus goes to the importer (e.g. Chinese consumers may enjoy the consumer surplus from squid, Japanese consumers often enjoy consumer surplus from salmon and urchin roe). Recreation-related businesses contribute to local consumer surplus when they sell products to locals, and to non-local consumer surplus when they offer their wares to out-of-towners.

The distinction between economic impact and value is important for a number of reasons. First, it usually is not in society's best interest to support economic activity that does not increase overall economic well-being. Economic activities that require large subsidies to operate may generate economic impacts, but if the cost of doing business is greater than the revenues (in other words the economic value is negative), society could have invested in other activities with greater economic return. This is the argument made against farm and timber subsidies.

Second, and equally important, from the perspective of the coastal economy is the fact that many recreational opportunities along the California coast are available at little or no charge. The surfer who walks to the beach may not spend a dime to surf, but that surfer still enjoys her surfing experience. If she can't surf, not only does she lose value, she may end up spending money to drive somewhere else to surf. In many cases, the reason people choose to live near the coast is so they can participate regularly, and easily, in coastal recreational activities. The consumer surplus of coastal recreation is sometimes referred to as the "non-market value" of coastal recreation because in California, unlike many East Coast states, people are not charged to walk onto piers, wharfs, and beaches. Ultimately, these non-market consumer surplus values find their way into the market. The consumer surplus associated with coastal recreation eventually finds its way into the value of coastal homes. Even local wages may be lower than for non-coastal areas (for instance, everyone along coastal California knows someone who could earn more if they only left the coast and went to work in Sacramento, Chicago, or New York).

Today, more and more coastal managers are starting to weigh the tradeoffs between those strictly commercial activities that require coastal resources (e.g. commercial fishing and tourism) and other coastal uses that may offer smaller economic impacts, but more consumer surplus (e.g. recreational fishing, birding, surfing, beachgoing, etc.).

This section examines some of the key elements of the local economy. The discussion is not meant to be definitive or comprehensive, but does reveal what has been learned during the past three years as available data have been compiled on these economic activities. Data are provided where possible and simple discussion for other areas such as tourism and housing, where data are not readily available. Having painted a clearer picture of the estuary economy in this section, Chapter 6 focuses on the potential impacts of proposed restoration alternatives on these activities.

## 2.1 Commercial Fishing

Creating a safe harbor for commercial fishing vessels was a major reason for the creation of the Moss Landing Harbor (Pomeroy and Dalton 2003). Pomeroy and Dalton conducted a detailed examination of the Moss Landing commercial fishery finding the port served as home for 125 resident and 175 non-resident fishing operations as well as seven resident and many non-resident fish buyers (Pomeroy and Dalton 2003). Pomeroy and Dalton estimated the direct economic value of commercial fishing in Moss Landing to be between $18 million and $25 million per year (year 2000 dollars based on data from 1999-2001).

The commercial fishery in Moss Landing, however, is a cyclical one (figure 1). The years examined by Pomeroy and Dalton are above the average for the last two decades in terms of landed value for the local fishery with landed revenues of almost $16 million (adjusted to year 2007 dollars). Over the last thirty years, the value of landings has cycled from lows of just over $4 million to a high of almost $19 million in 1978. More recently, the fishery has seen a substantial decline in the value of fish landed in Moss Landing, with 2007 landings earning just over $6 million.

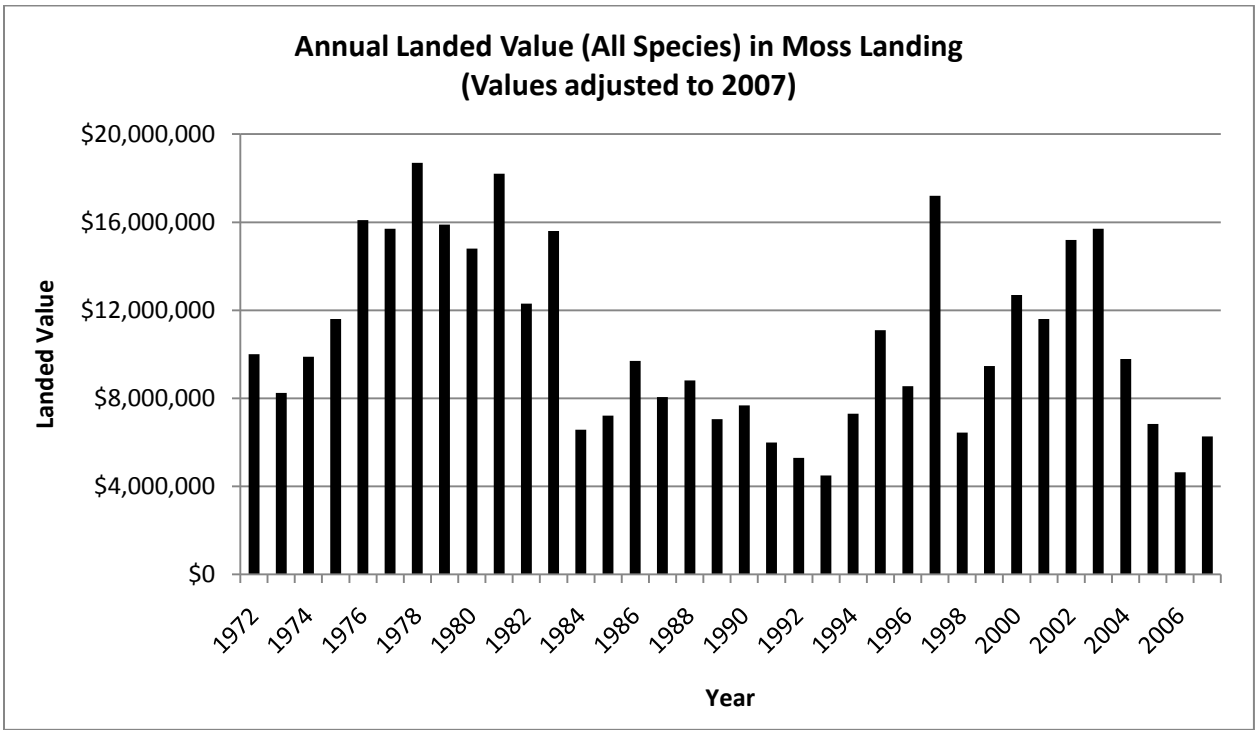



**Figure 1 Landed value of commercial fish - Moss Landing**

**Table 1 Landed value of selected species - Moss Landing**

| | Landed Value (adjusted to 2007) | | |
|---|---|---|---|
| | **1977** | **1997** | **2007** |
| **Anchovy** | $1,322,325 | $124,348 | $846,550 |
| **Rockfish** | $674,853 | $412,941 | $102,793 |
| **Sardines** | $0 | $1,278,637 | $3,226,008 |
| **Squid** | $124,599 | $2,506,243 | $2,093 |
| **Total** | **$2,121,777** | **$4,322,169** | **$4,177,444** |

The composition of catch in the commercial fishery has changed considerably over time (table 1). While squid accounted for more than half of all total landed value in 1997, by 2007 the squid fishery was almost inconsequential. Sardines and anchovy landings (and landed value) almost disappeared during the late 1980s and early 1990s, but appear to be reaching near historic high levels for the last thirty years (years for which data are available, figure 2 and figure 3). Other finfish landed in Moss Landing have experienced consistent declines in catch with lingcod and rockfish catches at all time lows in 2007 (figure 4 and figure 5). The commercial salmon fishery in California was closed completely in April 2008. The Pacific Fishery Management Council will re-evaluate the condition of the California salmon fishery in April 2009. The California salmon fishery has been struggling since 2005, with low catch rates in 2005 and 2007 and a disastrous season in 2006 (PFMC 2008).

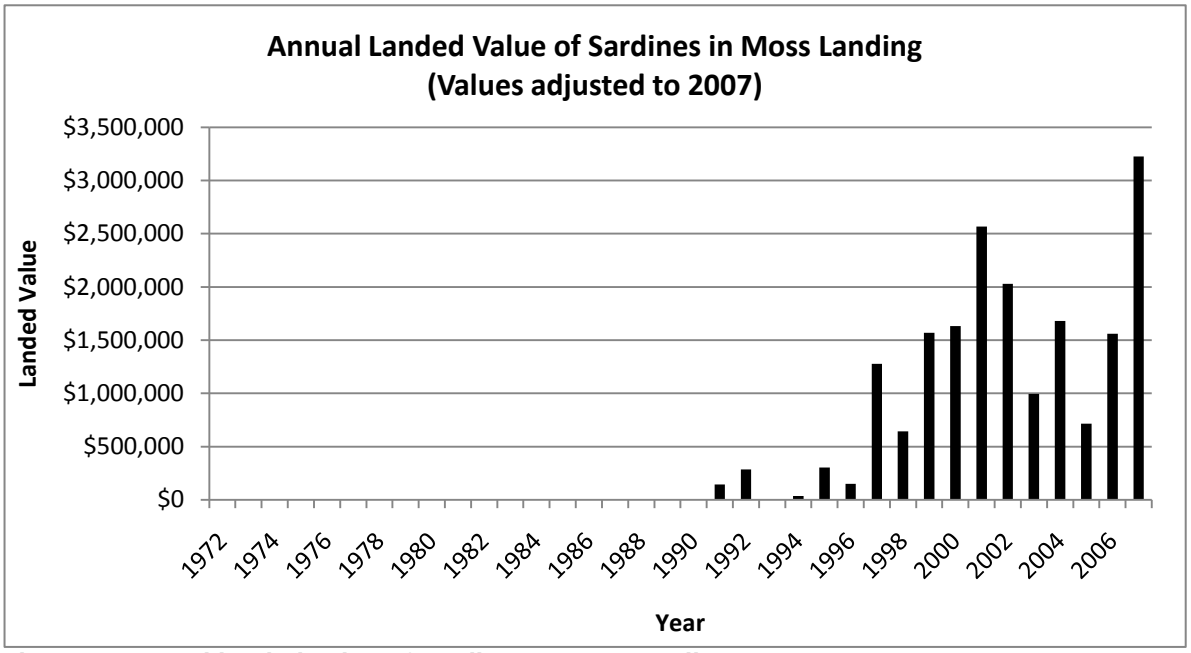



**Figure 2 Annual landed value of sardines - Moss Landing**

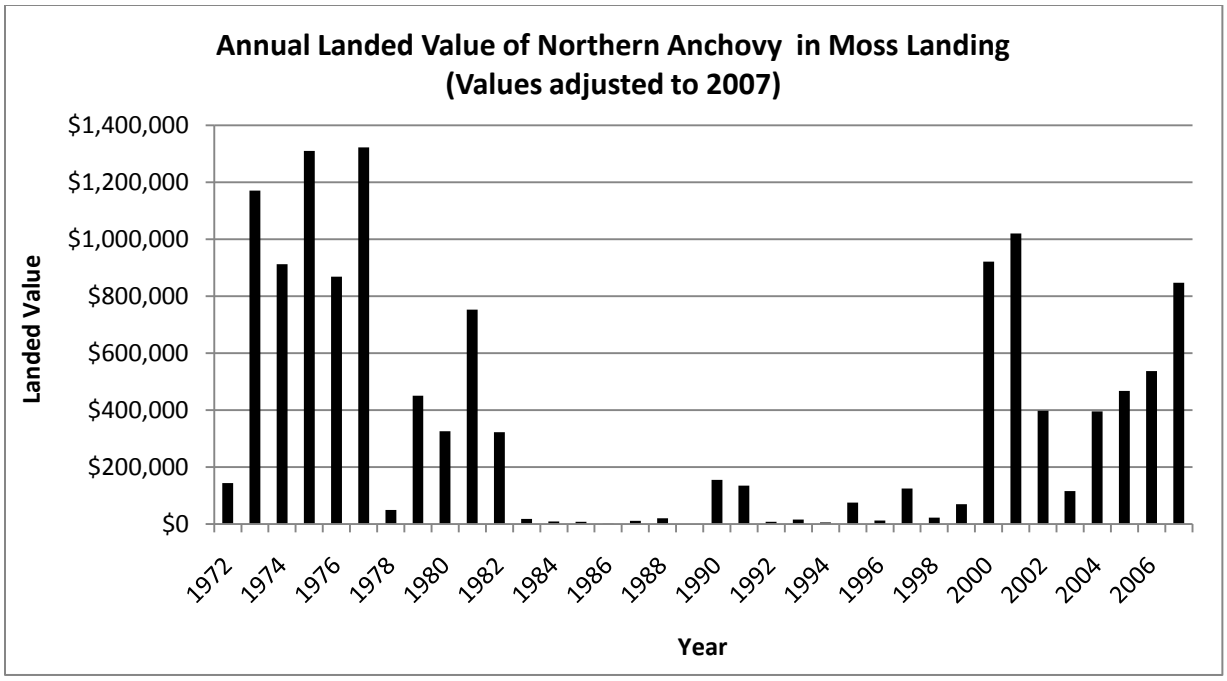



**Figure 3 Annual landed value of anchovies - Moss Landing**

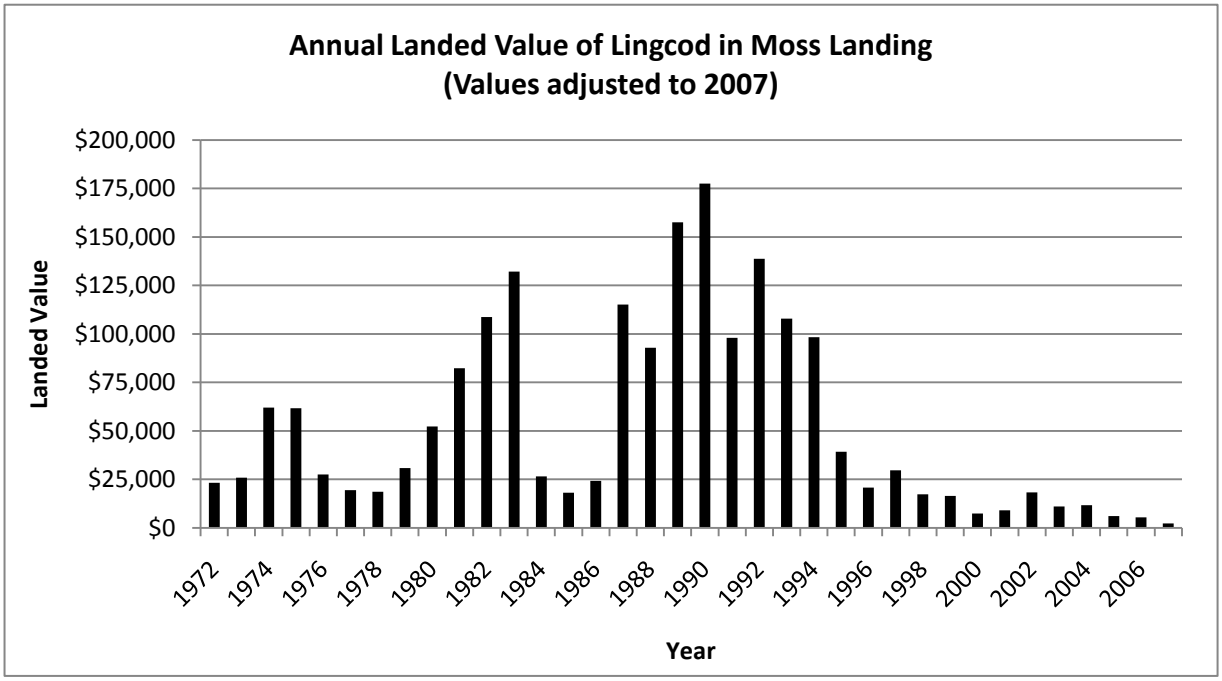



**Figure 4 Annual landed value of lingcod - Moss Landing**

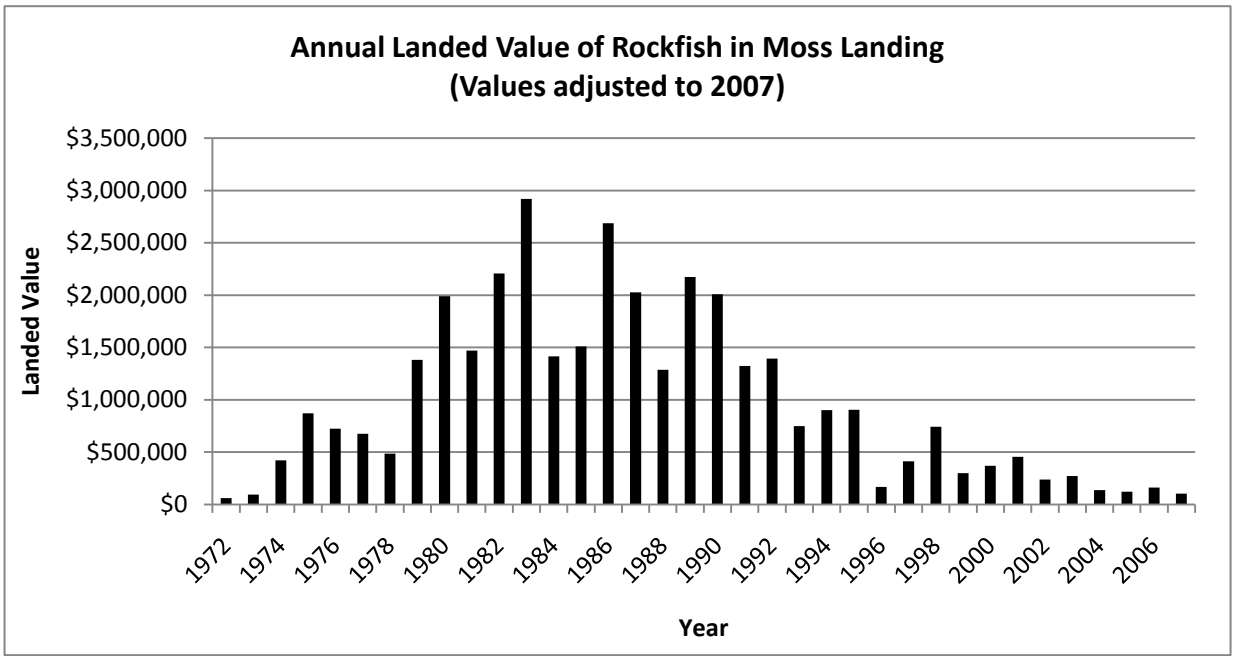



**Figure 5 Annual landed value of rockfish - Moss Landing**

While the value of current catch is below historic averages for Moss Landing, the return of anchovies and sardines (figure 2 and figure 3), historically a mainstay for the Monterey Bay fisheries, has helped the Moss Landing commercial fishery weather the collapse that has affected the rest of the commercial fishery from Santa Cruz south to the ports of Long Beach and San Pedro – a fishery that has declined by more than 90 percent since the mid-1970s (figure 6). Even at nearby Morro Bay, the decline in non-wetfish species (especially rockfish) has led to a substantial decline in the overall value of the fishery, where the value of commercial fishing landings were less than $2 million in 2007 (figure 7). ("Wetfish" traditionally refer to anchovy, sardines, market squid, tuna, and mackerel.) It is likely that the economic contributions of the fishery as evaluated by Pomeroy and Dalton represent years of above average productivity in the Moss Landing fishery (average inflation adjusted landed value for 1987 to 2007 was $9.16 million while the inflation adjusted average for 1999 to 2001 was $11.25 million). The current value of the fishery is likely to be roughly half that estimated by Pomeroy and Dalton (landed value in 2007, $6.27 million, was less than 56 percent of the inflation adjusted landed value average from 1999 to 2001).

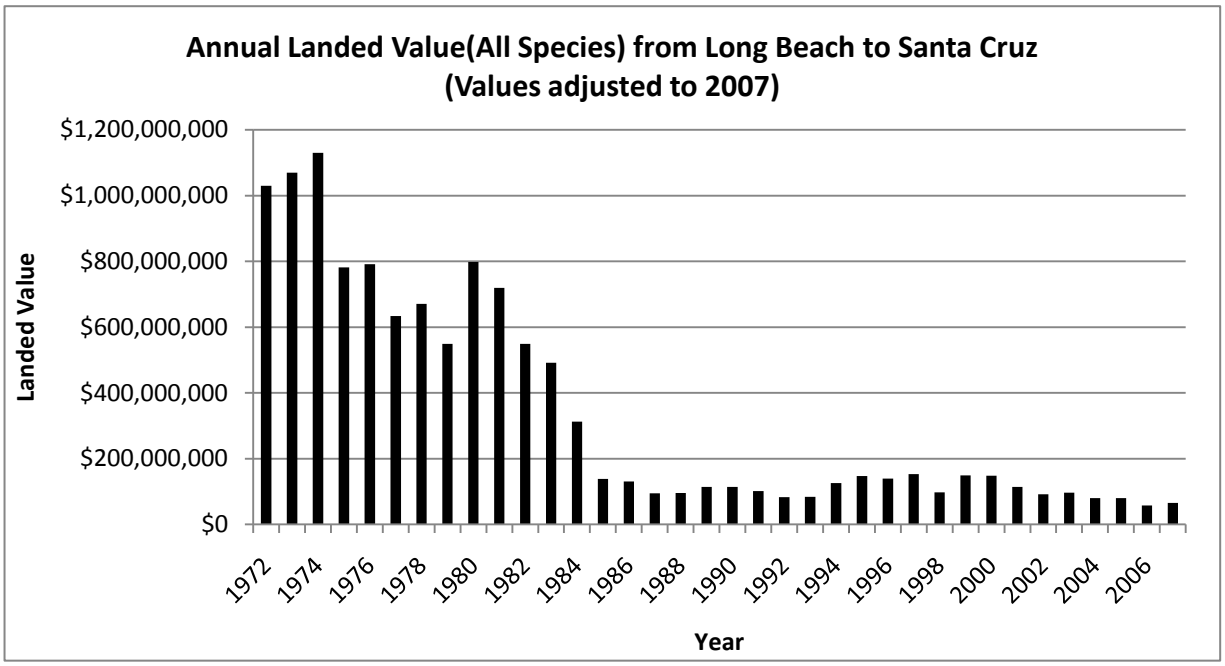



**Figure 6 Annual landed value - Santa Cruz to Long Beach**

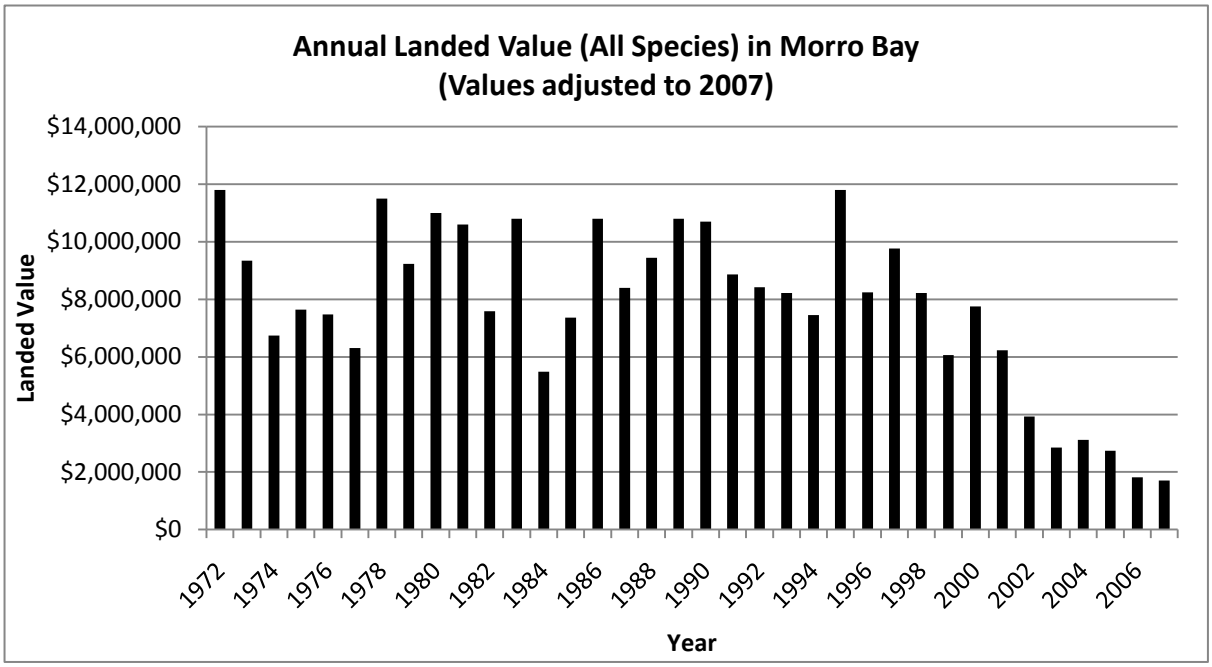



**Figure 7 Annual landed value - Morro Bay**

## 2.2 Recreational Fishing and Commercial Passenger Fishing Vessels

Recreational fishing from charter boats also is an important and well-known component of the Moss Landing economy. According to the California Department of Fish and Game, six vessels with a home port of Moss Landing were registered as commercial passenger fishing vessels (CPFVs) in 2007. Data also are available from DFG on the number of vessel-trips (a single trip taken by a single vessel) and angler-trips (a single trip taken by a single angler) on charter vessels leaving and returning to Moss Landing. (We warn the reader that these data are provided voluntarily by vessel owners. The NOEP experience analyzing these data in other areas of the Central Coast finds that vessel activity reported to us by vessel owners does not always agree with DFG data.)

Recreational fishing from charter boats out of Moss Landing seems to have peaked in late 1990s and early 2000s, with up to 200 vessel-trips (figure 8) made serving more than 2,500 anglers (figure 9). More recently, reported activity on charter fishing boats has declined with just over 100 vessel trips serving approximately 1000 anglers in 2006 and 2007. Well-publicized closures in the recreational salmon industry are no doubt to blame for some of this decline. While total activity on charter fishing vessels around the state has been in decline over the last ten years (figure 10), DFG reported that CPFV activity in nearby Morro Bay (figure 11) appears to have increased over the last ten years (although local charter boat owners disagree with these findings).

While the budget did not allow for a cost-earnings study of the charter vessel industry in Moss Landing, the literature does provide some guidance on the size of expenditures made by charter boat anglers. In a summary of the literature, Pendleton and Rooke (2008) find that daily expenditures for anglers using a party or charter boat in California ranged from $94 to $564 (2006 dollars). Assuming an inflation adjusted value of approximately $100 per angler trip, it can be assumed that expenditures by charter boat anglers coming to Moss Landing were on the order of $2.5 million in the early 2000s and have likely fallen to around $1 million in 2006 and 2007.

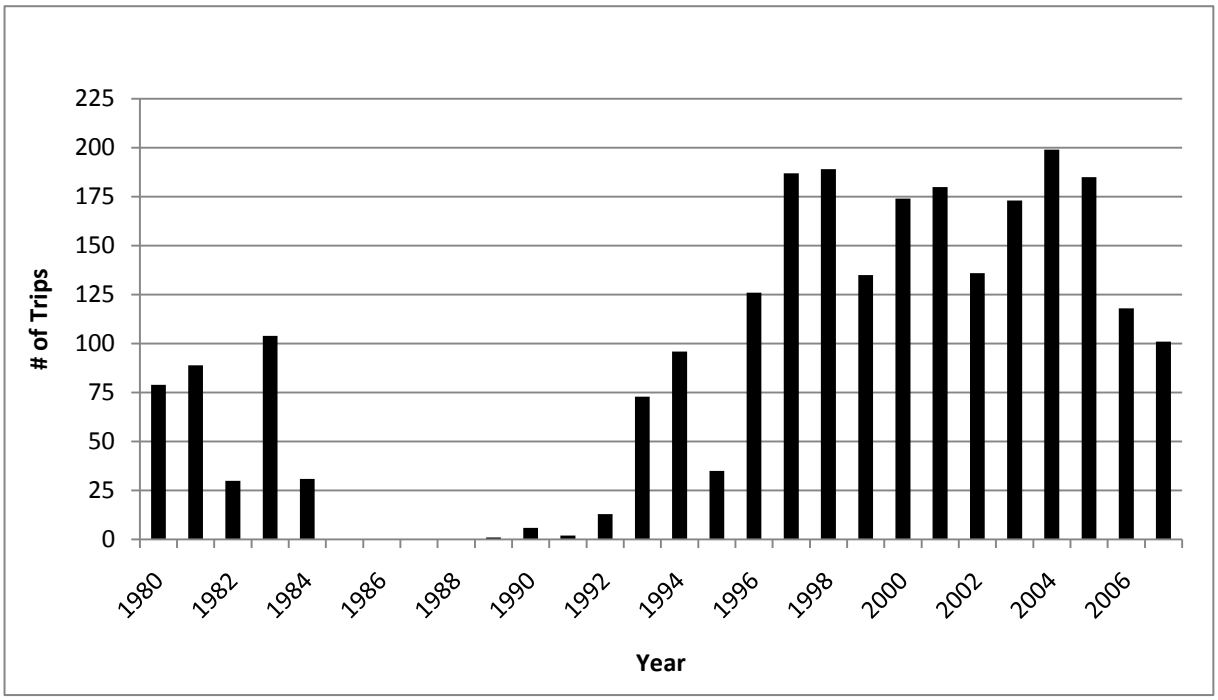



**Figure 8 Moss Landing annual number of vessel-trips for CPFV**

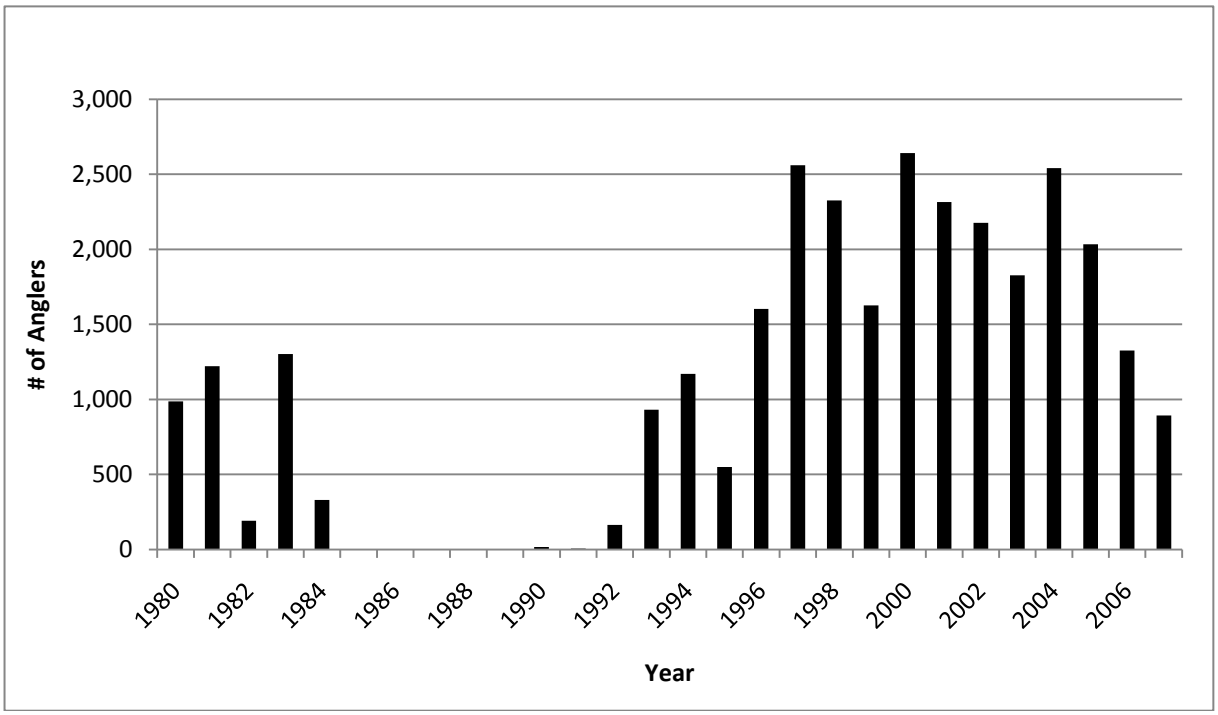



**Figure 9 Moss Landing annual angler-trips on CPFVs**

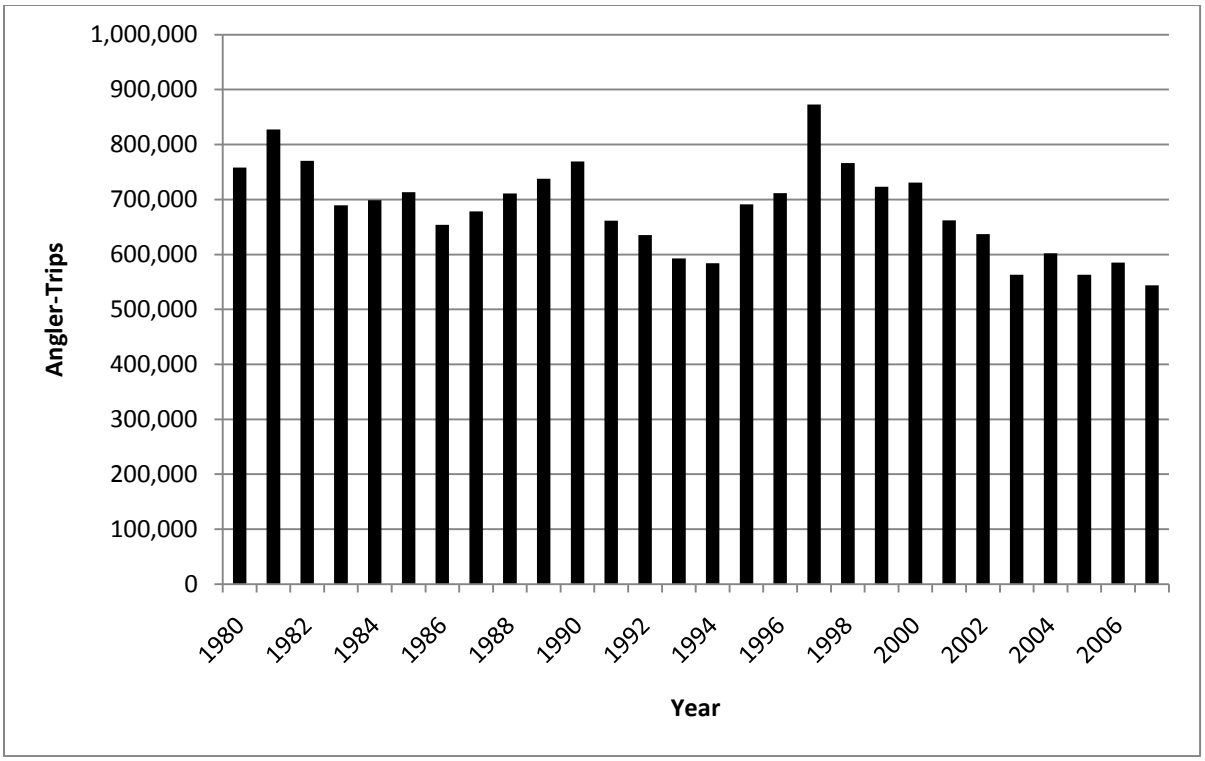



**Figure 10 California annual angler-trips on CPFVs**

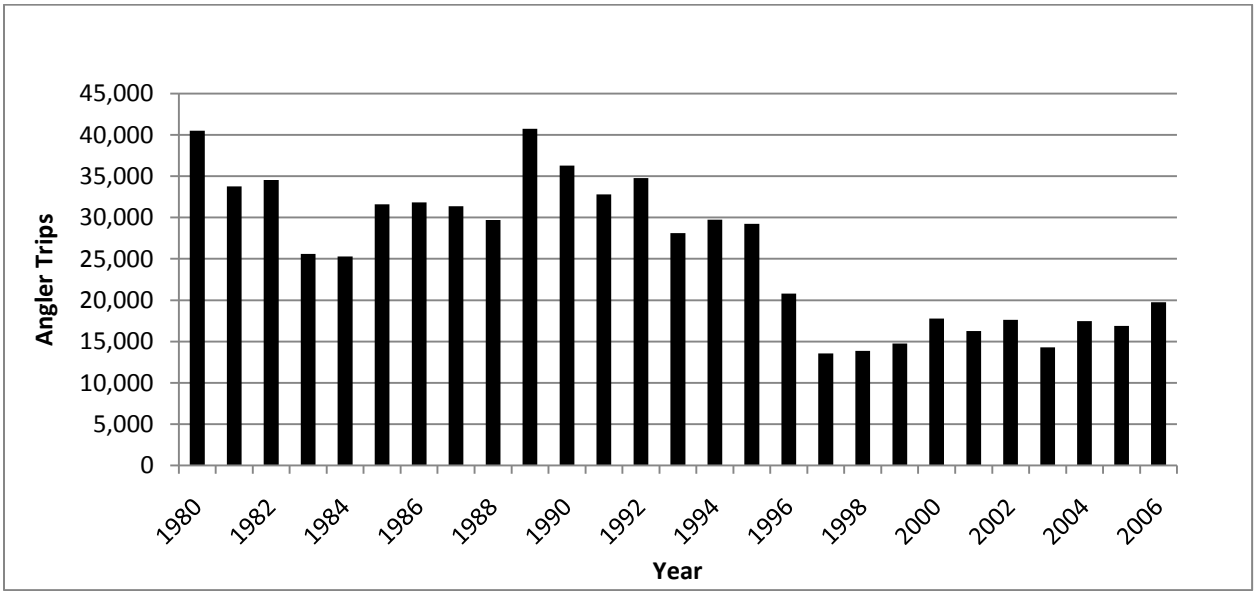



**Figure 11 Morro Bay annual angler-trips on CPFVs**

## 2.3 Nature Tourism and Outdoor Recreation

Elkhorn Slough has much to offer the outdoor enthusiast. The Slough and its surroundings offer opportunities for hiking, wildlife viewing, kayaking, recreational fishing, and even swimming at the nearby beaches of Salinas River State Beach and Moss Landing State Beach. Because Elkhorn Slough is one of few estuaries on the west coast of North America, it serves as an important wintering and stopover site for many birds and is considered by the Audubon Society to be an Important Bird Area (Audubon 2009). The Slough and Moss Landing also offer a rare refuge for otters with rafts of otters easily seen from many locations in the Slough. Elkhorn Slough has been estimated to support up to 4 percent of the entire Southern sea otter population (Kieckhefer et al. 2007).

Many businesses in Moss Landing benefit in one way or another from the presence of the Slough and the recreational opportunities it offers. Because there are so few businesses in the Moss Landing area, economic data are not regularly collected from these businesses. The small number of businesses also makes it difficult to reveal data about these businesses without divulging proprietary information (a number of recreation-based businesses in Moss Landing were contacted, data on number of visitors or revenues were unavailable). As a result, little is known about the economic impact of tourists and day-use visitors to the Slough. Four businesses cater directly to tourists and recreationists: the Captain's Inn, two kayak shops that serve the Slough directly (Monterey Bay Kayaks and Kayak Connection), and the Elkhorn Slough Safari which offers guided pontoon boat excursions in the Slough. A small, but thriving restaurant business exists in Moss Landing and while some of the customers to these eateries work at local research institutions and businesses, many are nature tourists and visitors who have come specifically to the Slough for recreational opportunities. Even those that stop to eat as they are passing through the Moss Landing area may be inclined to do so due to the ease of seeing otters before, after, or while dining.

A comprehensive count of visitors to the Elkhorn Slough and Moss Landing has never been conducted. Data on attendance to local beaches and the Elkhorn Slough National Estuarine Research Reserve (ESNERR) Visitor Center have been collected regularly. While there appears to be some variation in the intensity of data collection over time, a summary of annual attendance data compiled by ESNERR volunteer Michael Fineman shows that attendance to the Visitor Center has varied between 25,000 and 35,000 visits annually, with a possible downturn in recent years (figure 12). Data at the two local beaches (Moss Landing State Beach and the Salinas River State Beach) show a similar downturn over the past couple of years. The California State Parks reports that attendance at Moss Landing State Beach peaked in 2003 with approximately 350,000 visits annually, but reported attendance has declined significantly with only 200,000 visits reported annually in 2006 and 2007 (figure 13). Reported attendance at the Salinas River State Beach peaked in 2002 with nearly 600,000 annual visits, but has since fallen to approximately 250,000 annual visits in 2006 and 2007 (figure 14). It is important to recognize that there is likely to be considerable error in these state visitation estimates. The intensity of estimation varies at these parks from year to year and both parks rely on estimates, not actual counts. Still, these approximate numbers give us some idea of the potential ballpark contribution that beach going may make to the local economy. While it is unclear exactly how much these beach goers are spending in the Elkhorn Slough/Moss Landing area, Pendleton and Kildow (2006) reviewed the literature and found that on average, beach goers tend to spend roughly $25

per trip on local expenditures (e.g. food, rentals, ice, etc.). Based on this figure, day-use visitors to these two beaches could account for something on the order of $12 million in local spending at current levels of attendance.

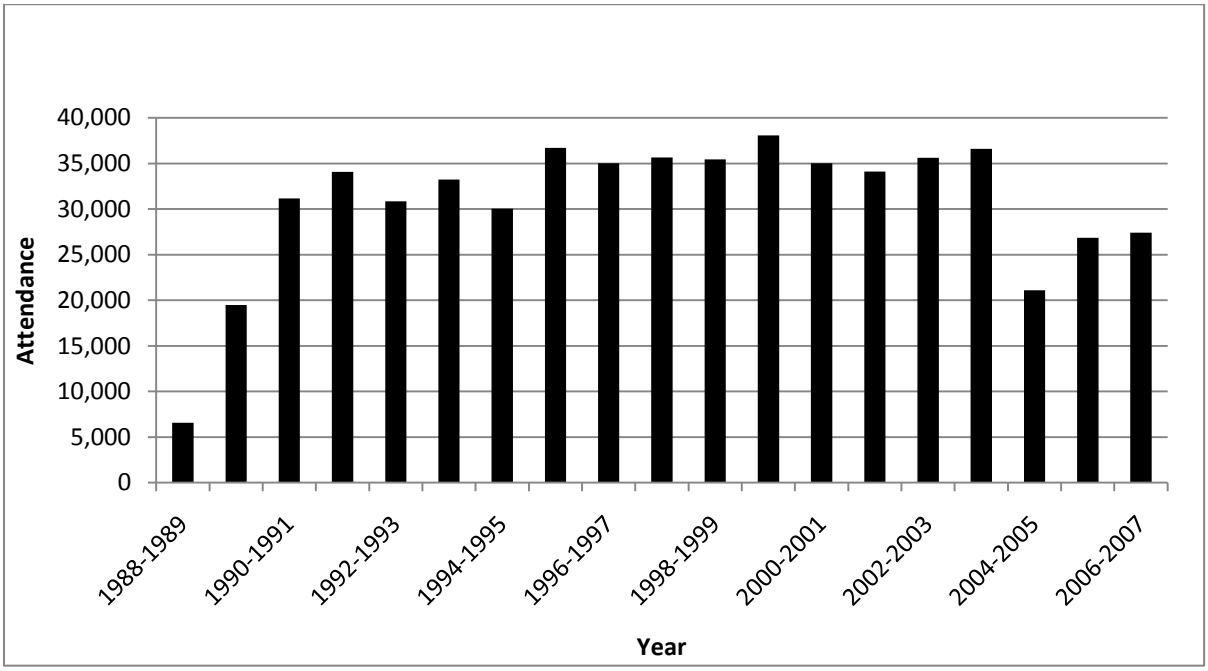



**Figure 12 Attendance: ESNERR Visitor Center**

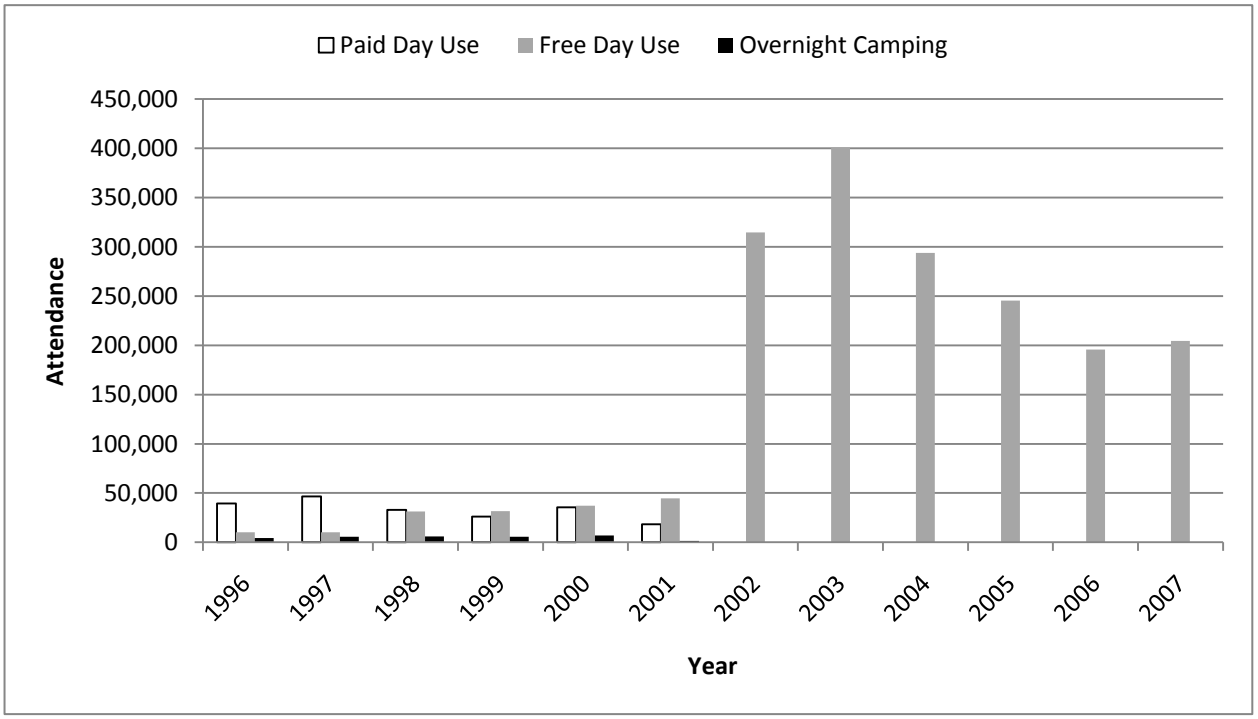



**Figure 13 Attendance: Moss Landing State Beach**

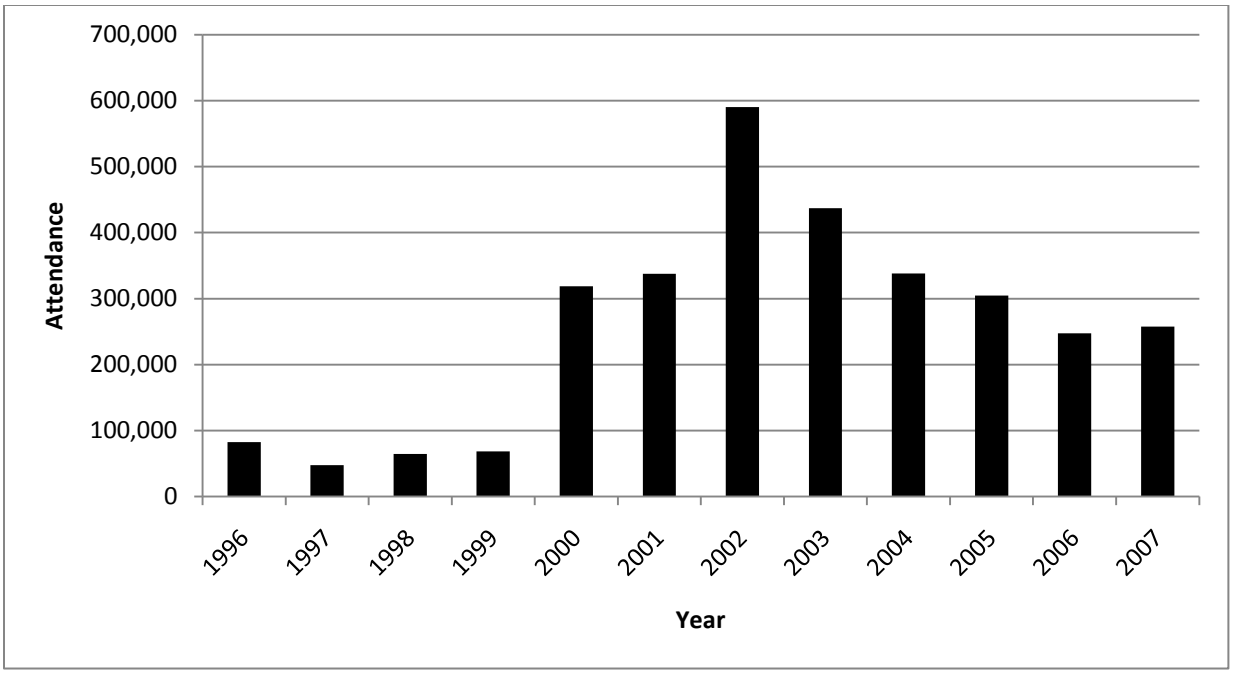



**Figure 14 Attendance: Salinas River State Beach (free day-use only)**

To better understand who visits the Slough and Moss Landing area and how much they spend, a randomized survey of local visitors was conducted during the summer of 2008 (funded by a supplement from the Elkhorn Slough Foundation). A protocol was employed that was randomized by site, time of day, and by individual intercepted. Surveys were conducted for three, two-hour periods four days per week (randomized across weekdays and weekends). 310 responses were collected at eight sites in the Elkhorn Slough/Moss Landing area. The Slough was divided into sixteen areas for the purposes of quantifying locations visited and the activities respondents engaged in; for a map of these areas, see section 4.1.3. The results in table 2 show that most activity in the Slough occurs in the Moss Landing Harbor area (Moss Landing North and Moss Landing South).

**Table 2 Areas visited by respondents**

| | Total Number of Visits* | Percent Visitation |
|---|---|---|
| Bennet Slough | 7 | 2.3% |
| Moss Landing North | 133 | 42.9% |
| Moss Landing South | 142 | 45.8% |
| Moro Cojo Slough | 5 | 1.6% |
| CDFP Wildlife Area | 63 | 20.3% |
| Seal Bend/Rubis Creek | 58 | 18.7% |
| Moon Glow Dairy | 20 | 6.5% |
| ESNERR South | 35 | 11.3% |
| South Marsh | 35 | 11.3% |
| Visitors Center | 67 | 21.6% |
| ESNERR North | 47 | 15.2% |
| North Marsh | 5 | 1.6% |
| Kirby Park | 65 | 21.0% |
| Hudson's Landing | 5 | 1.6% |

| | Total Number of Visits* | Percent Visitation |
|---|---|---|
| Porter Marsh | 2 | 0.6% |
| Monterey Bay | 19 | 6.1% |

*Includes all locations that were visited at least once.

The survey was based on the internet pretest survey conducted using Survey Monkey and a mass email mailing sent to members of the ESNERR email list. Based on the randomized summer survey, the findings show that median per trip expenditures by Slough visitors were lower than the per person-day expenditures estimated by Pendleton and Kildow (2006). The median expenditure by Slough visitors was $18 per trip and $7.50 per person-day with those engaging in kayaking spending the most, bird and wildlife watchers spent just above the overall median and recreational fishers (those not fishing on charter boats) spending substantially under the overall median (table 3). (Note per person per day expenditures follow a similar pattern, but are substantially less.) Visitors to the ESNERR Visitor Center reported spending a median of $7.61 per person per visit. With attendance at the Visitor Center ranging from 25,000 to 35,000 over recent years, it can be estimated that Visitor Center visitors alone contribute between $190,000 and $266,000 per year to the local economy. Further, based on the survey responses, only 21.6 percent of those interviewed went to the Visitor Center during the current trip. Using the percentage of overall visitors compared to the percentage that went to the ESNERR Visitor Center (100%/21.6%) suggests that overall visitation to the Slough and Moss Landing area are likely to be on the order of 115,000 to 135,000 visits with associated spending on the order of $.86 to $1.01 million annually. Chapter 4 takes a deeper look into the activities of these visitors.

**Table 3 Median expenditures by visitors to Elkhorn Slough and Moss Landing**

| | Median Expenditure /trip | Median Expenditures /person-day |
|---|---|---|
| Kayaking | $32 | $17 |
| Birding | $20 | $7.5 |
| Wildlife Viewing | $20 | $10 |
| Fishing | $12 | $2 |
| Overall Median (any activity) | $18 | $7.5 |

## *2.4 Recreational Boating*

Recreational boating also is an important part of the Moss Landing marine economy, yet one that is poorly studied. Currently, the harbor collects slip fees and other income from more than 600 slips that are used by pleasure craft, commercial, and scientific vessels. Data are not available currently that show how many of these slips are occupied by recreational vessels, nor are data available on expenditures by boat owners in the area. Nevertheless, data on average boater expenditures were collected by two national boater surveys conducted by Michigan State University's (MSU) Recreation Marine Research Center (studies conducted in 2005 and 2006, see MSU, 2009). These data, combined with data on economic multipliers are available in an interactive model that can be used to estimate the economic impacts that are likely to result due to expenditures by recreational boaters keeping their slips moored in a marina setting. Annual expenditures include those on storage (during the boat season), taxes, replacement outboard motors, trailers, fuel, repairs and marine services and accessories. Since most boats, trailers, motors and other sorts of major equipment are not manufactured in the area, only the resale and

wholesale margins on these purchases are included in the estimation of economic impacts. Per trip expenditures include what boaters spend on groceries, lodging, entertainment and restaurants. These estimates came from a 2006 national survey of more than 6,000 boaters that gathered information about more than 13,000 boating trips. All figures are adjusted to 2007 dollars. The average number of estimated annual trips for pleasure craft in the West Coast of the Continental United State also was estimated by the 2006 survey.

In the national survey by MSU, spending was found to vary by size of recreational vessel and whether that vessel was a sail or power boat. We do not have data on the distribution of sizes of vessels or data on sail versus power. For purposes of illustration, assume a scenario in which these 600 slips are divided equally among sail and power pleasure craft and between vessels greater than and less than forty feet (table 4). Again, these data do not reflect the actual distribution of vessels in slips in Moss Landing, but they do provide insight into the order of magnitude of boating-related spending that could result if all of these slips were filled with recreational pleasure craft.

**Table 4 Example of estimated number of boating days for 600 recreational slips**

| Boat Type and Size | Number of Boats | Average Days Per Boat | Total Boat Days |
|---|---|---|---|
| Power <40' | 150 | 32 | 4,783 |
| Power 40'+ | 150 | 45 | 6,818 |
| Sail <40' | 150 | 30 | 4,548 |
| Sail 40'+ | 150 | 33 | 4,878 |
| **Total** | **600** | **35** | **21,026** |

The MSU model provides estimated spending in nine categories (table 5). Economic impacts for the region, estimated using IMPLAN[2], are defined to include roughly a thirty mile radius of the marina. Because the size of multipliers differ depending on the size and nature (e.g., types of businesses) of the local economy, distinct sets of multipliers were developed for rural (populations less than 100,000), small metro (populations between100,000 and 500,000), and larger metro regions (populations over 500,000). Multipliers representing small metro areas were selected for this analysis. The model uses economic ratios to estimate wages, salaries, and jobs supported by the boater spending. Total effects include the direct sales, jobs and income in firms selling directly to boaters. To remain consistent with other figures presented in this section, indirect effects in firms that supply goods and services to boating businesses or induced effects resulting from household spending of income earned directly or indirectly from boater spending are not included here.

Based on the Michigan State University Model, it can be estimated that 600 recreational slips, distributed evenly across power and sail boats and boats greater than and less than forty feet, could generate nearly $7 million in annual local spending, supporting roughly one hundred jobs (table 5). (Note, to put the MSU results in context, the MSU model predicts that the hypothetical

[2] IMPLAN is an economic impact modeling system. The IMPLAN database contains county, state, zip code, and federal economic statistics, which are specialized by region, not estimated from national averages and can be used to measure the effect on a regional or local economy of a given change or event in the economy's activity.

boaters examined would spend $2.3 million annually on slip fees. The Moss Landing Harbor District reports slip related revenues of $1.6 million annually.)

**Table 5 Estimated economic impact of both annual vessel expenses and trip spending by recreational boats**

| Sector/Spending category | Sales ($ Thousands) | Jobs | Labor Income ($ Thousands) | Value Added ($ Thousands) |
|---|---|---|---|---|
| **Direct Effects** | | | | |
| Lodging | 29.3 | 0.6 | 12.8 | 20.8 |
| Marina Services | 2,752.7 | 52.8 | 1,010.3 | 1,692.9 |
| Restaurant | 710.4 | 17.8 | 279.2 | 315.4 |
| Recreation and Entertainment | 107.1 | 2.1 | 39.3 | 65.9 |
| Repair and Maintenance | 2,244.2 | 16.2 | 428.6 | 985.2 |
| Gas Service | 185.8 | 2.2 | 71.9 | 93.5 |
| Other Retail Trade | 861.3 | 20.7 | 397.4 | 550.9 |
| Wholesale Trade | - | - | - | - |
| Other Local Production of Goods | - | - | - | - |
| **Total Direct Effects** | **6,890.80** | **112.40** | **2,239.50** | **3,724.60** |

## *2.5 The Harbor*

Even before a new ocean inlet was created at Moss Landing in 1947, the Elkhorn Slough Estuary provided some refuge for large boats plying the waters of Monterey Bay (PWA 2008). It was not until the completion of the ocean inlet and the dredging and development of the Moss Landing Harbor, though, that the Slough and the associated harbor at Moss Landing became an important fishing port and later a safe harbor and marina for pleasure craft and research vessels.

As mentioned above, the harbor supports more than 600 slips and berths used by commercial vessels, pleasure boats, and research vessels. Vacancies of these slips has remained at 15 percent on average since the harbor began collecting and reporting data on slip vacancies in 2004, indicating that the harbor continues to enjoy high demand for berthing. The harbor district, which earns revenues from slip fees, lease operations, live-aboard charges, and fees on local businesses, has earned more than $1.6 million annually on these boating-related revenues since the fiscal year 2000-2001 (figure 15) (Moss Landing Harbor Department). (Note, the MSU model predicts slip fees for full occupancy of 600 slips on the order of $2.3 million annually.)

Additionally, the harbor district is a landlord to numerous businesses which, in turn, pay rents and leases totaling more than $400,000 over the last two fiscal years. This figure has remained steady over the last few years and has increased substantially since the mid 1990s (figure 16) (This pattern for harbor revenues is similar to that found in neighboring Morro Bay, but at about half the total amount of Morro Bay's revenues from harbor district leases which have averaged approximately $900,000 over the last four years.)

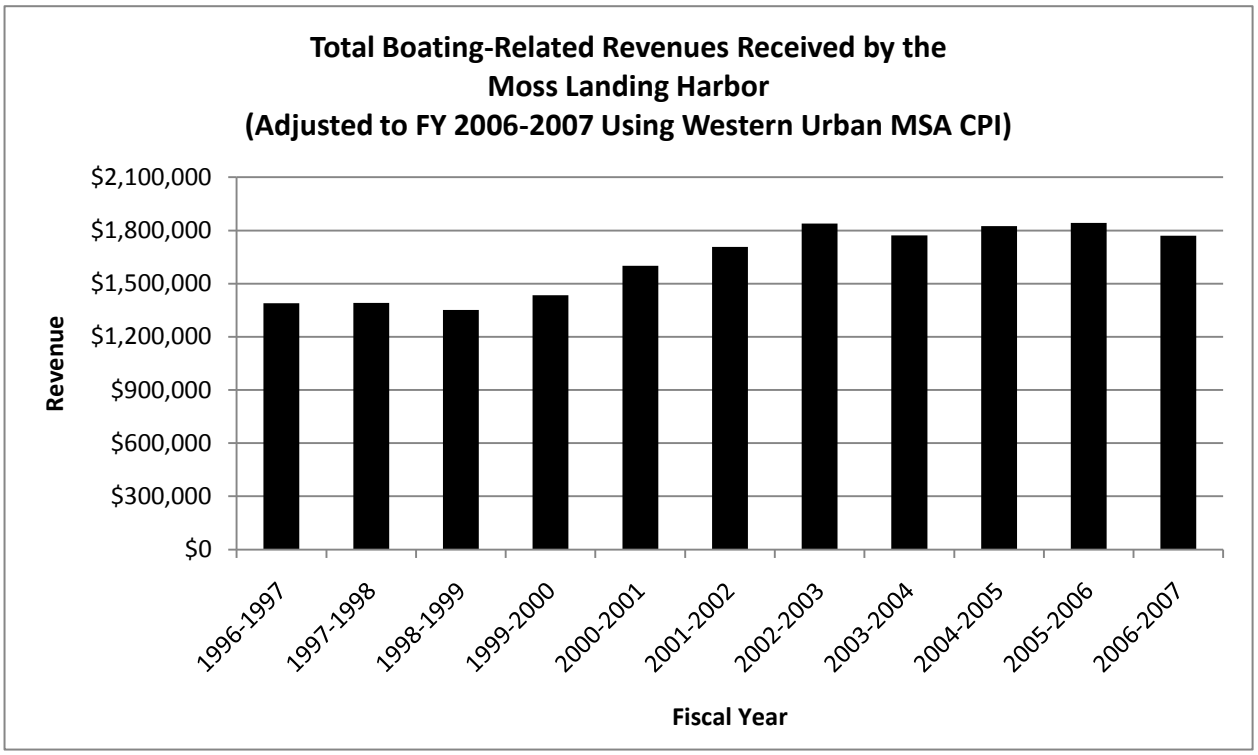



**Figure 15 Boating-related Moss Landing Harbor District revenues**

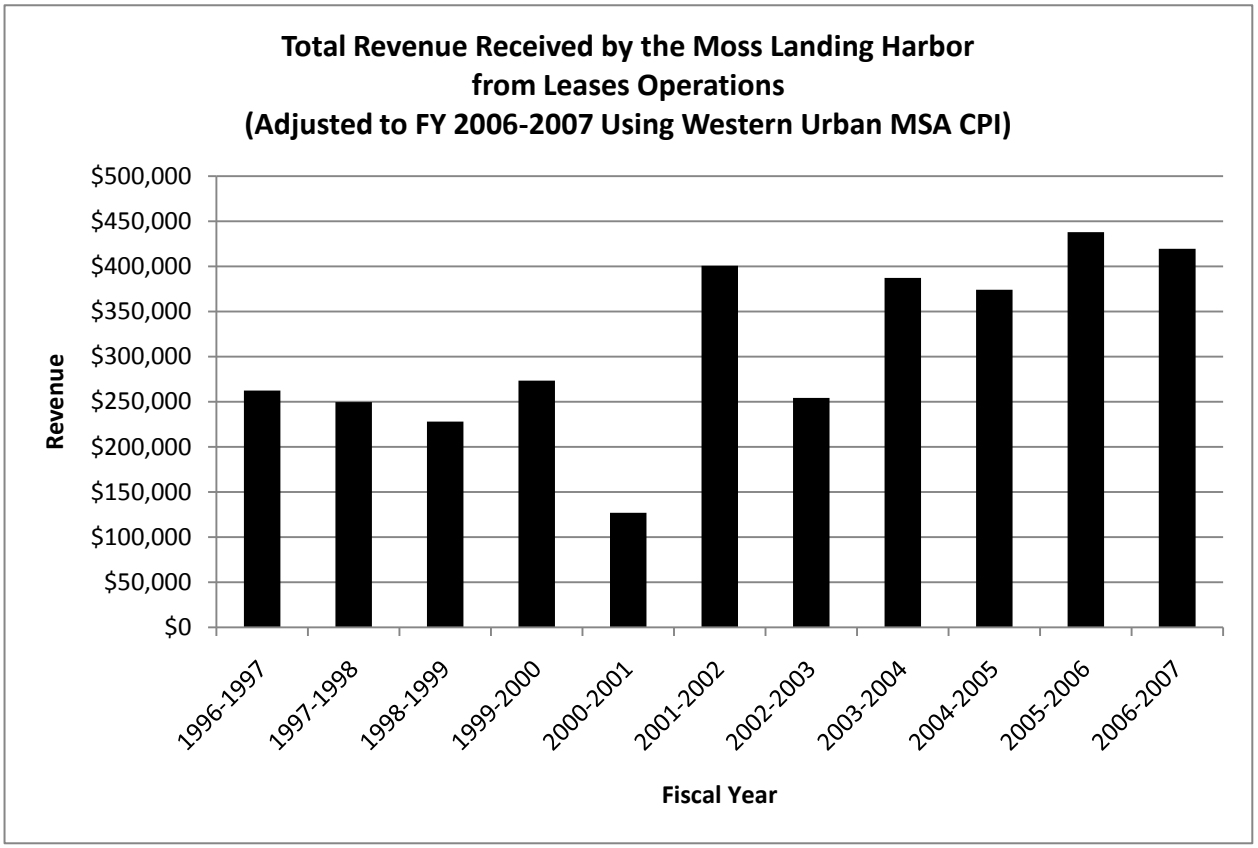



**Figure 16 Moss Landing Harbor District lease revenues**

## 2.6 Power Generation

The Moss Landing Power Plant is a prominent feature of the region's landscape and has had a significant impact on the local economy. The power plant supplies energy to the Monterey Bay area, provides jobs for the region, and provides staff that visit local restaurants and shops. We tried numerous times to collect basic economic data on power plant revenues and local economic spending, but were unsuccessful. Nevertheless, recent additions to the Moss Landing Power Plant cost more than $500 million in 2000 and the plant operates both peak and off-peak generators. With a capacity of 2590 megawatts, the plant is theoretically capable of generating nearly twenty-three million megawatt-hours with a retail market value worth almost $3 billion.[3]

## 2.7 Research Institutions

Finally, much of the area's international fame is derived from its world famous research institutions: the Moss Landing Marine Laboratory and the Monterey Bay Aquarium Research Institute which combined support more than 420 jobs and operate on annual budgets that exceed $67 million (Miller and Kildow 2007). While much of the research of these two institutions occurs in the deep ocean just outside of Moss Landing, other research and training is conducted within the Slough. Further, it is unlikely that either research institution would be in the area if not for the safe harbor offered by Moss Landing. In addition to oceanic research, the Elkhorn Slough also hosts two research and conservation organizations dedicated directly to a better understanding and protection of the biological resources of the Slough. ESNERR and the Elkhorn Slough Foundation support more than forty jobs and have annual operating and research budgets of more than $2.5 million (not including budgets for land acquisition).

## 2.8 Conclusion

From Highway One, the Moss Landing/Elkhorn Slough economy appears to be an economy based on electric power generation and fishing. In fact, that roadside impression tells only part of the story. The Elkhorn Slough/Moss Landing economy is a diverse one. Indeed, power generation dominates any calculation of the value of the area to the state's overall economy. (For a summary of order of magnitude estimates of economic activity in the Moss Landing/Elkhorn Slough area, see table 6). While commercial and charter boat fishing clearly are key elements of the local economy (on the order of $11 million to $27 million annually), recent research by the National Ocean Economics Project shows that research and conservation are likely to generate significantly more to the economy in terms of gross revenues (Miller and Kildow 2007).

Less easily quantified is the economic contribution of tourism and recreation (including boating and private recreational fishing) in the Elkhorn Slough and Moss Landing areas. Official data are not collected on tourism and restaurant operations and data from local businesses were unavailable, even from those who expressed interest initially in providing such data. Only one overnight accommodation exists in the Slough, with ten rooms the most expensive of which rents for $265/night. At this rate, it can be estimated that the maximum gross revenues from accommodation at this hotel are likely to be well under $1 million/year (even assuming ten rooms at $265 per night at full occupancy). It is completely unknown how many people are

[3] Based on the average retail price of electricity for all sectors in CA. Electric Power Monthly. September 2008. Energy Information Administration. U.S. Department of Energy.

drawn to stay in neighboring cities because of recreational opportunities at the Slough or what economic contribution is made to local restaurants and shops by those people whose primary purpose for visiting the Moss Landing area is to participate in some sort of recreational activity.

It is important to remember that gross revenues and budgets tell only part of the story. Little is known about how these revenues are spent – how much of fishing revenues, research budgets, or power plant earnings go to the purchase of vessels and equipment from outside of the area; how salaries are distributed among people who live locally and those that live farther away; or how much net economic value (that is value beyond the costs of operation) is generated by these activities. The varied economic activities in the Moss Landing/Elkhorn Slough area (e.g. power plant, commercial fishing, research, recreation, and tourism) all are likely to differ substantially in the degree to which expenditures, revenues, and jobs remain local.

These issues of net value and distribution of value become even more important when considering the potential economic value of recreation to the Slough. Many people are able to enjoy, at little or no cost, the open spaces and natural amenities of the Elkhorn Slough and nearby beaches. Nevertheless, these recreational opportunities have been shown repeatedly in the literature to have substantial economic value to these types of users – a value known as non-market value. For instance, Pendleton and Rooke (2008) estimate that recreational fishing in California is likely to generate a non-market value far greater than $300 million annually. Pendleton and Kildow (2006) estimate that beach going statewide generates more than $2 billion annually. The authors find that beach goers tend to enjoy an average non-market value of roughly $15 per beach visit (year 2006 dollars) which would suggest that the non-market value of beach going at Moss Landing and Salinas River State Beaches could generate on the order of $7 million annually in economic value to beach goers. Pendleton (2005) estimates that whale watching alone in the state generates more than $40 million in non-market value.

Finally, as more homes are built within view of the Slough, it is important to consider the economic contribution of the Slough to the value of these homes. In a recent summary of the literature, Kildow (2008) shows that a number of studies now indicate that ocean, bayfront, and estuary views increase home values. In the same report, Kildow also describes studies (e.g. Leggett and Bockstael 2000) that show water quality has an effect on nearby home values. The capital value of homes that may be influenced by the Slough is undetermined, but likely to be large and on an order comparable to other major economic uses of the Slough.

Like other estuary regions in the United States (see Colgan 2008), the small footprint of the Elkhorn Slough and Moss Landing supports a surprisingly active and valuable local economy. Virtually all of the economic sectors discussed here depend in some way on the presence of the Slough and the Moss Landing Harbor and the environmental and ecological condition of its waters. Yet, to date, very little information has been collected on the estuary-dependent economy. We do not have good time series data that links changes in Slough conditions to changes in economic activity. As a result, when it comes to the Slough and the nearshore of Monterey Bay that adjoins the Slough more is known about bacteria than beach goers, more about fish than private recreational fishers, more about the benthos than boaters, and more about birds than birdwatchers. Clearly, the economic stakes are high in this region. Management of the Slough is likely to have impacts on the Slough economy. Chapter 4 provides an overview of

what is known and not known about how changes in the ecological and environmental condition of the Slough and Moss Landing could affect these economic activities. We then examine how proposed restoration alternatives may affect these economic uses of the region.

**Table 6 Summary: order of magnitude of economic activity in Moss Landing/ Elkhorn Slough**

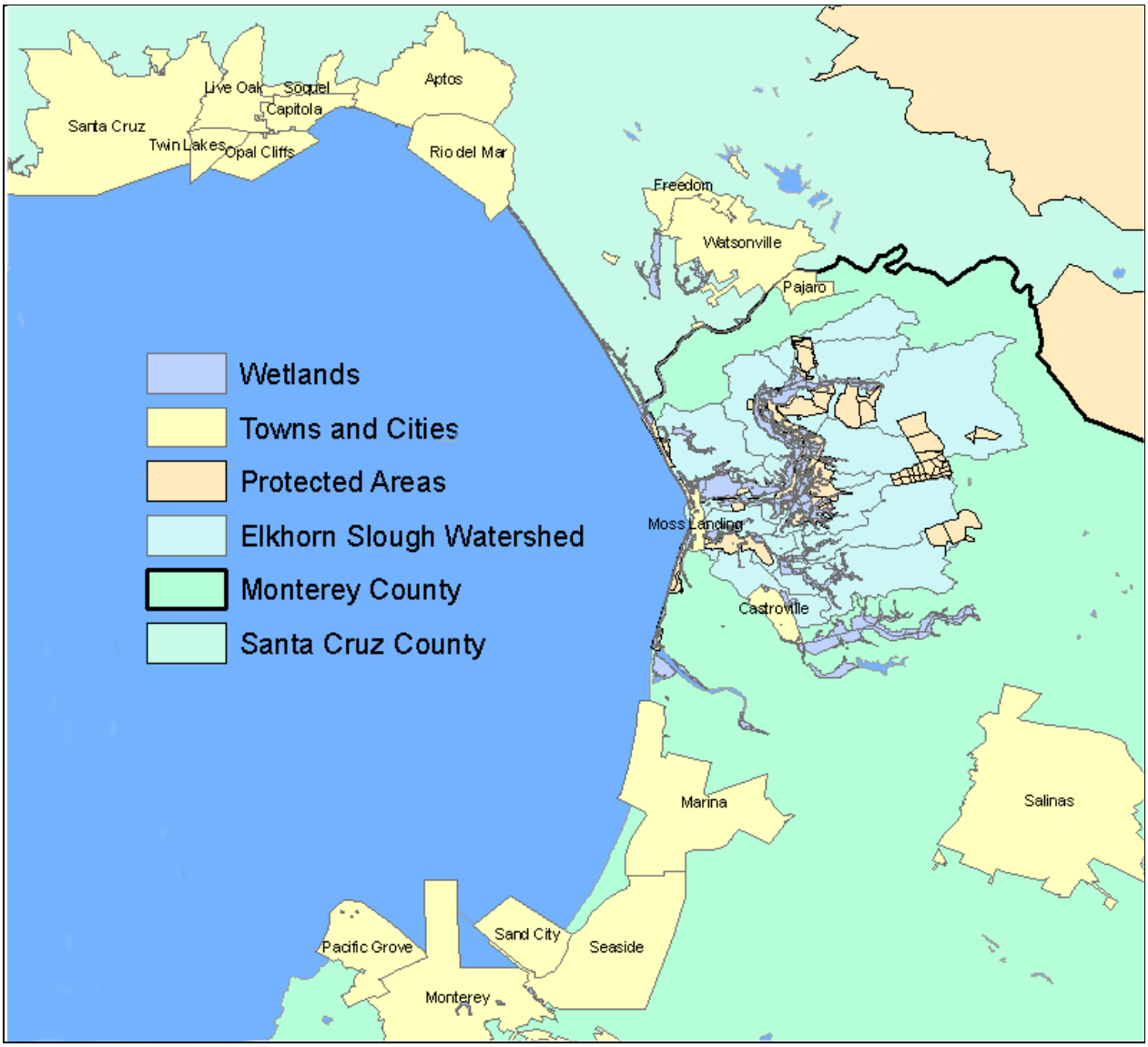
| Economic Activity | Most Recent Estimate of Annual Economic Impact (Gross Revenue or Expenditures, 2007 dollars unless otherwise noted) | Most Recent Estimate of Annual Economic Value | Year |
|---|---|---|---|
| Commercial Fishing (landed value) | $6 million (landed value) ($18-$25 million gross impact, year 2000 dollars) | | 2007 (1999-2001) |
| Commercial Passenger Fishing Vessels (Charter Boats) | ~$1 million | | 2007 |
| Tourism and Recreation | Total unknown | | |
| Nature-based Recreation | $1 million | | |
| Beach going | ~ $12 million (expenditures) | ~ $7 million (non-market value) | 2007 |
| Recreational Boating | ~ $7 million | | |
| Moss Landing Harbor District | | | |
| Boating and vessel related fees | $1.6 million | | 2007 |
| Leases and fees | $400,000 | | 2007 |
| Power Plant (peak capacity retail value of electricity) | $1-3 billion | | 2008 |
| Research and Conservation (operating budgets) | ~$70 million | | 2007 |

# 3 An Inventory of the Political and Regulatory Landscape of Elkhorn Slough

The attempt to stabilize the erosion of salt marsh in Elkhorn Slough poses enormous challenges to those who will decide what to do. When restoring the estuary to a defined condition[4], project managers are confronted with political, legal and regulatory challenges. While sound scientific principles and best available technology are essential to their considerations, legal/political considerations and regulations have the potential to thwart restoration efforts if not fully considered and integrated into the planning process and courses of action. The following paragraphs provide a glance at the political landscape of the area that raises many potential issues that are considered in this report.

The Elkhorn Slough straddles Monterey and Santa Cruz counties, rests at the juncture of the Salinas and Pajaro river watersheds and at the edge of Monterey Bay, bounded by Moss Landing Harbor commercial and recreational fishing and boating harbor, and a band of beautiful sand beaches. It is surrounded mostly by farms and small residential communities on three sides and a small, limited commercial area at the edge of the harbor to the west. Its residents are served by two larger adjacent communities, Castroville to the south and Watsonville to the north. The largest cities, Santa Cruz to the north and Monterey to the South provide the Slough's visitors with additional destinations as well as a place to use as a base from which to visit the Slough. Its unique location includes two distinctive industrial facilities, a large gas-fired power plant and a railroad track that runs down the middle of the estuary. Finally, the most popular and scenic highway in California, State Scenic Highway 1, runs along the western edge of the Slough (see figure 17).

[4] Since many natural and human modifications occurred to the Slough ecosystem over time, difficulties persist in determining a baseline historical condition, which shifts over time.




*Source: Pat Johnston (NOEP)*

**Figure 17 Map of wetlands and adjacent counties**

This description portrays the human landscape for Elkhorn Slough. It does not begin to describe the natural landscape, which is at the core of its value to society, the state and the local communities, and is linked to many of the laws and regulations that are considered here. That description is found in other parts of this study and will be referenced from time to time in this report as appropriate. Describing the human landscape, however helps to demonstrate the complex network of government and non-government groups that hold jurisdictional and/or regulatory influence over what happens to the Slough.

The first thing to note is that there are multiple "property owners" in the Slough watershed, both public and private. There is no single entity with legal authority over the watershed that could be affected by the larger restoration options. Each of the restoration options under consideration would affect different scales of property in the Slough and therefore, has been analyzed with this in mind. Along with different property owners, there are many natural characteristics of the

Slough that are protected by numerous laws and require permits to change, if they might be impacted in any way, ranging from endangered species and marine mammals and water quality to water flows. This chapter describes the numerous laws, regulations and jurisdictions that are likely to be involved in a restoration, and have been considered in the final analyses of restoration options. Included also are the numerous stakeholders that use or depend on the Slough, many of whom have been described in the economic chapters.

## *3.1 Legal and Regulatory Considerations*

A number of federal, state, and local regulatory considerations exist that will affect the planning, implementation, and outcome of each restoration alternative of the Elkhorn Slough estuary. A list of potential legal, political, and regulatory constraints for project feasibility are listed below. Each regulation is conditional, based on the following variables:

- Funding sources
- Regulatory jurisdictions
- Zoning, planning, and development
- Exemptions
- Affected parties and private industries

The next section outlines a possible regulatory framework subject to the broad range of restoration activities.

### 3.1.1 Federal Laws

#### *Federal Endangered Species Act (ESA)*

Both the Department of Commerce National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the U.S. Department of Interior Fish and Wildlife Service (FWS) share responsibility for administration of the Endangered Species Act of 1973 (ESA). The ESA protects listed wildlife species from harm or 'take'. The term 'take' is broadly defined as 'harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct'. An activity is defined as a 'take' even if it is unintentional or accidental. Individuals planning to conduct any activity resulting in the 'take' of an endangered or threatened species, whether or not deliberate, must possess an Incidental Take Authorization Permit to perform that activity. This permit would consist of a Biological Opinion and Incidental Take Statement which must establish that the proposed 'take' would not jeopardize the continued existence of the endangered or threatened species.

Issuance of an Incidental Take Authorization may occur either under Section 10(a) of the ESA for projects that have no other federal involvement, or under Section 7 of the ESA for projects that require funding or permits from other federal agencies. Since the proposed Elkhorn Slough restoration alternatives would likely require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (Corps), Section 7 consultation between the Corps and the U.S. Department of Interior FWS and/or Department of Commerce NOAA NMFS would be required for any identified federally listed endangered and threatened species.

### *Clean Water Act Section 404*

The Corps is responsible under Section 404 of the Clean Water Act (CWA) for regulating discharges of fill or dredged material into waters of the United States. Waters of the United States and their lateral limits are defined in 33 CFR (Code of Federal Regulations) Part 328.3(a) and include streams that are tributary to navigable waters and adjacent wetlands. Wetlands that are not adjacent to waters of the United States are termed 'isolated wetlands' and may be subject to Corps jurisdiction if they have a hydrological connection to waters of the United States. In general, either a nationwide or individual section 404 permit must be obtained before placing fill or dredging in designated wetlands or other waters. Nationwide permits are authorized for certain categories of projects that are deemed to have minimal impacts on aquatic resources. National Environmental Policy Act (NEPA) review is required for each nationwide permit, although once established, project specific NEPA compliance is not required for subsequent actions. The U.S. Environmental Protection Agency (EPA) and FWS are responsible for reviewing permit applications and making approval determinations.

The Elkhorn Slough restoration activities will likely require a Section 404 permit. The type of permit required, nationwide or individual, depends on the amount of acreage involved and the end purpose and amount of any proposed fill.

### *Clean Water Act Section 401*

Section 401 of the CWA specifies that states must certify that any activity subject to a permit issued by a federal agency, such as the Corps, meets all state water quality standards. The Central Coast Regional Water Quality Control Board (RWQCB) is responsible regionally for taking certification actions for activities subject to any permit issued by the Corps pursuant to Section 404 (or for any other Corps permit, such as permits issued pursuant to Section 10 of the Rivers and Harbors Act of 1899). Actions may include issuance of a 401 certification noting that the activity subject to the federal permit complies with state water quality standards, issuance of a conditional 401 certification, and denial of 401 certification. In instances where the 401 certification is denied, the associated federal permit also is deemed denied.

The restoration alternatives for the Elkhorn Slough may require consultation with the RWQCB pursuant to Section 401.

### *National Environmental Policy Act (NEPA)*

NEPA directs all federal agencies to give appropriate consideration to the environmental effects of their decision making and to prepare detailed environmental impact statements (EIS) on recommendations or reports on proposals for legislation and other major federal actions significantly affecting the quality of the environment.

If any federal agencies are involved in either the funding or physical actions associated with the Elkhorn Slough restoration and the project is considered to have actions significantly affecting the quality of the environment, then NEPA documentation will be required. In this case, a joint EIS and study would likely be conducted due to the provisions contained under the California Environmental Quality Act (CEQA) (see #9). This would consist of state and federal agencies co-writing one environmental impact analysis of the chosen restoration project.

### *Fish and Wildlife Co-ordination Act*

The Fish and Wildlife Co-ordination Act (16 USC Sections 661-667e, March 10, 1934, as amended 1946, 1958, 1978 and 1995) requires federal agencies to consult with the FWS, NOAA Fisheries, and California Department of Fish and Game (CDFG) before they undertake or approve projects that control or modify surface water. The consultation is intended to prevent the loss of or damage to fish and wildlife in connection with water projects and to develop and improve these resources. Compliance with the Fish and Wildlife Co-ordination Act is incorporated into a project's NEPA process and therefore is relevant to the proposed project only after NEPA compliance has been triggered. Most FWS comments on applications for permits under Section 404 of the CWA or Section 10 of the Rivers and Harbors Act are conveyed to the Corps through the consultation process required by this co-ordination act. However, although the Corps must consult with FWS, it is not required to implement FWS recommendations.

### *Migratory Bird Treaty Act*

The Migratory Bird Treaty Act (16 USC 703–711) prohibits the take of any migratory bird or any part, nest, or eggs of any such bird. Under the act, take is defined as pursuing, hunting, shooting, capturing, collecting, or killing, or attempting to do so. Additionally, Executive Order 13186 (January 11, 2001) requires that any project with federal involvement address impacts of federal actions on migratory birds with the purpose of promoting conservation of migratory bird populations. The Executive Order requires federal agencies to work with the FWS to develop a memorandum of understanding.

### *Marine Mammal Protection Act*

The Marine Protection Act of 1972 as amended 2007 prohibits the take of any marine mammal. However, under the Act, the Secretary of the department in which NOAA is operating may issue permits authorizing the taking or importation of any marine mammal. The Secretary, on the basis of the best scientific evidence available and in consultation with the Marine Mammal Commission, shall prescribe such regulations with respect to the taking and importing of animals from each species of marine mammal (including regulations on the taking and importing of individuals within population stocks) as he deems necessary and appropriate to insure that such taking will not be to the disadvantage of those species and population stocks and will be consistent with the purposes and policies set forth in Section 2 of the Act.

### *National Marine Sanctuary*

The Monterey Bay National Marine Sanctuary (MBNMS) prohibits activities that dredge or deposit any part of the seabed within the Sanctuary (Title 15, CFR Section 922.132). Dredging permits may be obtained upon review if any of the Elkhorn Slough restoration activities fall within the MBNMS jurisdiction.

### *Elkhorn Slough National Estuarine Research Reserve (ESNERR)*

ESNERR encompasses about 1400 acres on the south and east side of Elkhorn Slough under the jurisdiction of CDFG. One of the big threats to the Elkhorn Slough is the degraded Slough habitats. The Reserve facilitates and encourages research on many topics, one of large

importance; restoration ecology of degraded Slough tidal habitats. A permit is required for any research done within Elkhorn Slough Reserve.

### 3.1.2 California State Laws

#### *California Endangered Species Act*

The CDFG has jurisdiction over threatened or endangered species that are formally listed by the State under the California Endangered Species Act (CESA). The CESA is similar to the ESA both in process and substance, with the intention of providing additional protection to threatened and endangered species in California. The CESA does not supersede the ESA, but operates in conjunction with it. Species may be listed as threatened or endangered under both acts (in which case the provisions of both state and federal laws apply) or under only one act. The California endangered species laws prohibit the take of any plant listed as endangered, threatened, or rare, even when incidental take is permitted under ESA. For example, species such as the clapper rail are fully protected from incidental take under CESA.

As landowner, CDFG is charged with ensuring that interim and long-term restoration actions comply with CESA, although CDFG does not need to issue itself a CESA permit.

#### *California Environmental Quality Act (CEQA)*

All Califonrnia agencies are responsible for implementing the CEQA. The basic purposes of CEQA are to: inform governmental decision makers and the public about the potential significant environmental effects of proposed activities; identify ways that environmental damage can be avoided or significantly reduced; require changes in projects through the use of alternatives or mitigation measures when feasible; and disclose to the public the reasons why a project was approved if significant environmental effects are involved. CEQA applies to projects undertaken, funded or requiring an issuance of a permit by a public agency. The analysis of a project required by CEQA usually takes the form of an Environmental Impact Report (EIR), EIS, Negative Declaration (ND), or Environmental Assessment (EA).

Any of the restoration alternatives for the Elkhorn Slough will be subject to CEQA provisions since it is a project that has a potential for resulting in physical change to the environment, and is an activity that may be subject to several discretionary approvals by governmental agencies. Therefore the projects would require an environmental analysis in the form of an EIR, which is a detailed report written by the lead agency describing and analyzing the significant environmental effects of a proposed project, identifying alternatives and discussing ways to reduce or avoid the possible environmental damage.

#### *Fully protected Species and Species of Special Concern*

CDFG maintains a list of Fully Protected Species and an informal list of Species of Special Concern. Fully protected species cannot be harmed or possessed at any time, and many of these species are also threatened or endangered.

Species of Special Concern are broadly defined as wildlife species that are of concern to the CDFG because of population declines and restricted distributions, and/or they are associated

with habitats that are declining in California. Impacts to species of special concern may be considered significant under CEQA.

### *California Fish and Game Code Section 3503*

According to Section 3503.5 of the California Fish and Game Code (Protection of Nesting Birds and Raptors), it is unlawful to take, possess, or destroy any birds of prey or to take, possess, or destroy any nest or eggs of such birds. Active nests of all other birds (except English sparrow and European starling) are similarly protected under Section 3503 of the California Fish and Game Code, as well as birds designated in the International MBTA under Section 3513 of the California Fish and Game Code. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered 'take' by CDFG. This statute does not provide for the issuance of an incidental take permit.

### *California Fish and Game Code Section 1602*

All diversions, obstructions, or changes to the natural flow, or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFG, pursuant to Section 1602 of the California Fish and Game Code. Section 1602 states that it is unlawful for any person to substantially divert or obstruct the natural flow, or substantially change the bed, channel, or bank of any river, stream, or lake designated by CDFG, or to use any material from the streambeds, without first notifying CDFG of such activity. The regulatory definition of a stream is a body of water that flows at least periodically or intermittently through a bed or channel that has banks and supports fish or other aquatic life. This includes watercourses with a surface or sub-surface flow that supports or has supported riparian vegetation. CDFG's jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife.

CDFG is charged with ensuring that interim and long-term restoration actions comply with the Fish and Game Code, depending on the restoration activities a Section 1602 permit may be required.

### *Porter-Cologne Water Quality Control Act*

Projects that affect wetlands or waters must also meet waste discharge requirements of the RWQCB under California's Porter–Cologne Water Quality Control Act. Under this Act, the RWQCB regulates the 'discharge of waste' to 'waters of the State'. Both of the terms 'discharge of waste' and 'waters of the State' are broadly defined in Porter-Cologne, such that discharges of waste include fill, any material resulting from human activity, or any other 'discharge' that may directly or indirectly impact 'waters of the State.' It is important to note that, while Corps Section 404 permits and RWCQB 401 certifications are required when the activity results in fill or discharge directly below the ordinary high water line of waters of the United States, any activity that results or may result in a discharge that directly or indirectly impacts waters of the State or the beneficial uses of those waters are subject to waste discharge requirements.

Waste discharge requirements may be applied to the Elkhorn Slough restoration project depending on the ultimate project design and use of fill materials.

#### *California Coastal Act*

The CCC regulates the use of land and water in the coastal zone in accordance with the Coastal Act (Division 20 of the Public Resources Code). The Coastal Act includes specific policies that address issues such as shoreline public access and recreation, lower cost visitor accommodations, terrestrial and marine habitat protection, visual resources, landform alteration, agricultural lands, commercial fisheries, industrial uses, water quality, offshore oil and gas development, transportation, development design, power plants, ports, and public works.

Development activities in the coastal zone typically require a coastal development permit from the CCC or in instances where local government has developed an approved local coastal plan (LCP), from the local governing agency. The Elkhorn Slough restoration project alternatives that fall within the coastal zone are within the jurisdiction of the CCC. Therefore, a Coastal Development Permit may be issued by the CCC following their review.

### 3.1.3 Local Development and Planning Laws

#### *Local Government*

The zoning and building codes, general plans, specific plans, and other planning and building policies of Monterey County or Moss Landing would apply to the Elkhorn Slough restoration activities. Project development activities would fall under Title 20 Zoning Coastal Implementation Plan, the Monterey County General Plan, Monterey County Local Coastal Plan, and the North County Land Use Plan. Each document contains a list of planning and development standards that must be met through presentation of thorough project evaluation and analysis.

One local agency that has jurisdiction that overlaps Elkhorn Slough is the Pajaro Valley Management Agency. This agency is chartered by the state and its role is "to efficiently and economically manage existing and supplemental water supplies in order to prevent further increase in, and to accomplish continuing reduction of, long-term overdraft and to provide and insure sufficient water supplies for present and anticipated needs within the boundaries of the Agency." This agency does not have permitting authority over restoration activities in Elkhorn Slough, although potential impacts of restoration activities on groundwater supplies must be taken into account.

#### *Moss Landing Harbor Ordinance Code*

The Moss Landing Harbor District (MLHD) serves commercial and recreational fishermen and residents of the North County and Greater Salinas areas. Construction permits under the MLHD Ordinance Code (Section 26.300) may be required under the restoration activities at Elkhorn Slough.

#### *Transportation Regulations*

Any alteration, creation, or impediment of a roadway will be subject to a set of transportation related laws and regulations with associated permitting processes. For the Elkhorn Slough, restoration Alternatives 2 and 3 would fall under this section with additional rules regarding bridges. Constructing a new bridge or modifying existing bridges requires authorization by the

U.S. Coast Guard. Any structure constructed over a navigable waterway is required to seek a Rivers and Harbors Act, Section 10 permit from the Corps. California Department of Transportation (Caltrans) requires encroachment permits for any activity occurring within the right of way. In addition, the project would be responsible for complying with other local municipality guidelines and permissions regarding activities on roadways.

There may also be required agreements between the Union Pacific Railroad and the project agencies, since the railroad crosses a section of the Elkhorn Slough and may be potentially affected by the restoration activities.

## *3.2 Jurisdictional levels of federal, state, and local agencies*

A map showing jurisdictional levels of federal, state, and local agencies reveals a web of consultations, permissions, and authorities included in the restoration process for range of options outlined. Below is an organizational chart illustrating the government entities affiliated with the Tidal Wetland Plan (figure 18). This organizational chart indicates which agencies are charged with issuing and enforcing permits, as well as mapping how decisions may flow through the agencies.

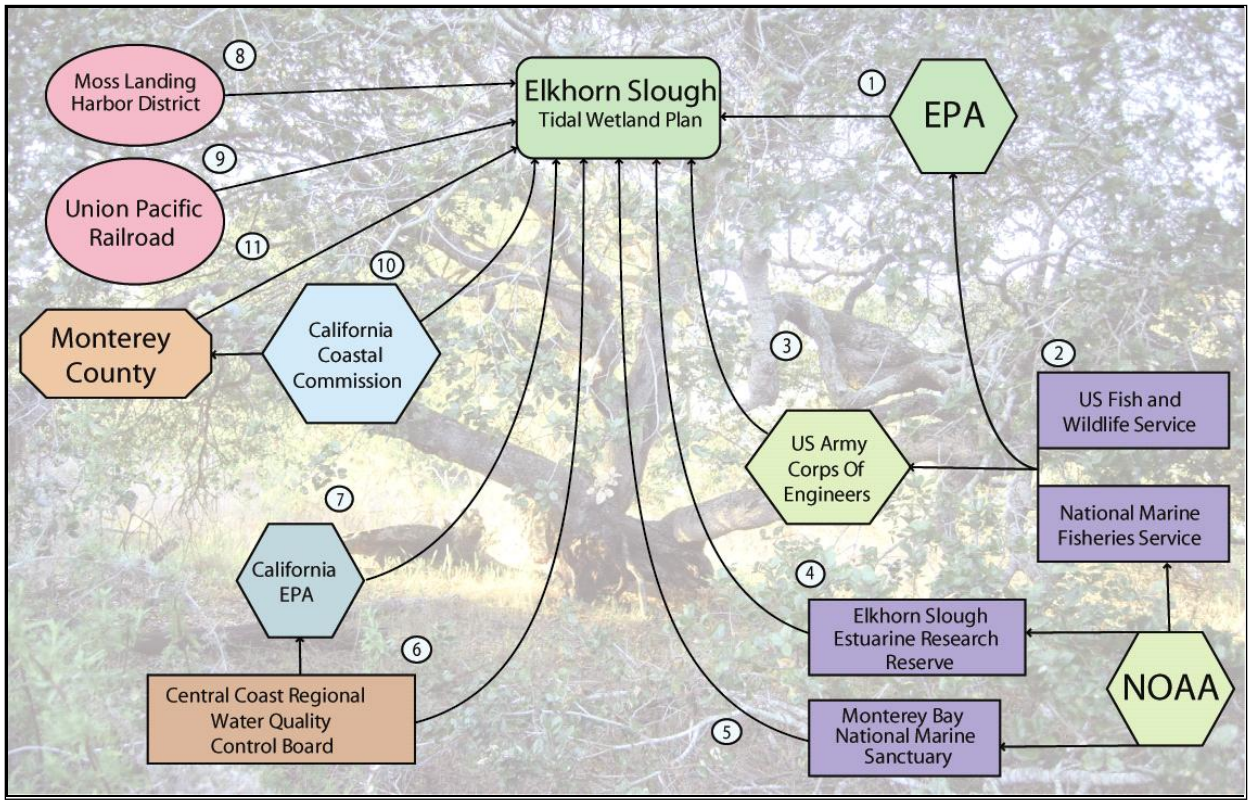



**Figure 18 Permitting authority diagram: government entities**

1. In accordance with the NEPA process, an EIS must be acquired by any lead agency in situations where environmental impacts are possible.
2. Provides input for Corps permits under section 404 of the Clean Water Act.
3. Issues nationwide and individual permits for wetland restoration.

4. A permit is required for any research done within Reserve boundaries.
5. Issues permits for conducting research and restoration activities within sanctuary boundaries.
6. In order to file for Corps permits a Water Quality Certification is required.
7. In accordance with the California Environmental Quality Act (CEQA) process, an EIR will be necessary.
8. The MLHD is authorized by the California Harbor and Navigation Code to require permits for various activities within the harbor.
9. The Union Pacific must approve restoration activities that can affect the railroad.
10. In order to file for Corps permits, a Coastal Development Permit is required.

Even though the California Coastal Commission (CCC) retains regulatory control over the wetlands within the coastal zone, it gives local governments the ability to regulate wetland development.

This report discusses a number of potential impacts raised by stakeholders that have direct policy connections. Knowing the actors involved in the restoration process and anticipating their concerns will create less difficulty during the restoration option screening process. Below is a systems chart that maps the negotiation path through the relevant regulatory agencies that will have authority over the selected options (figure 19).

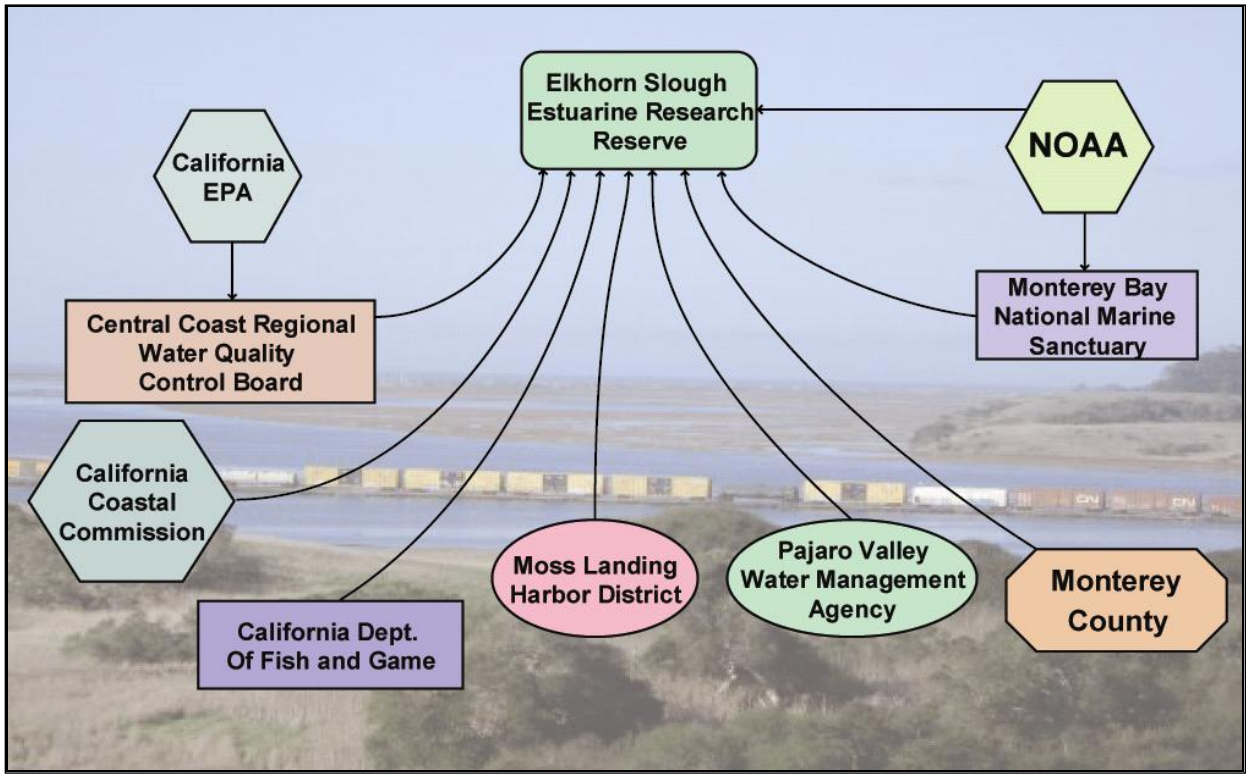



**Figure 19 Regulatory systems diagram**

Elkhorn Slough falls under two federal jurisdictions under NOAA, which will require a permit to conduct research and restoration activities: MBNMS and ESNERR. Elkhorn Slough east of the Highway 1 Elkhorn Slough Bridge falls under MBNMS (Part 922.130). The potential restoration

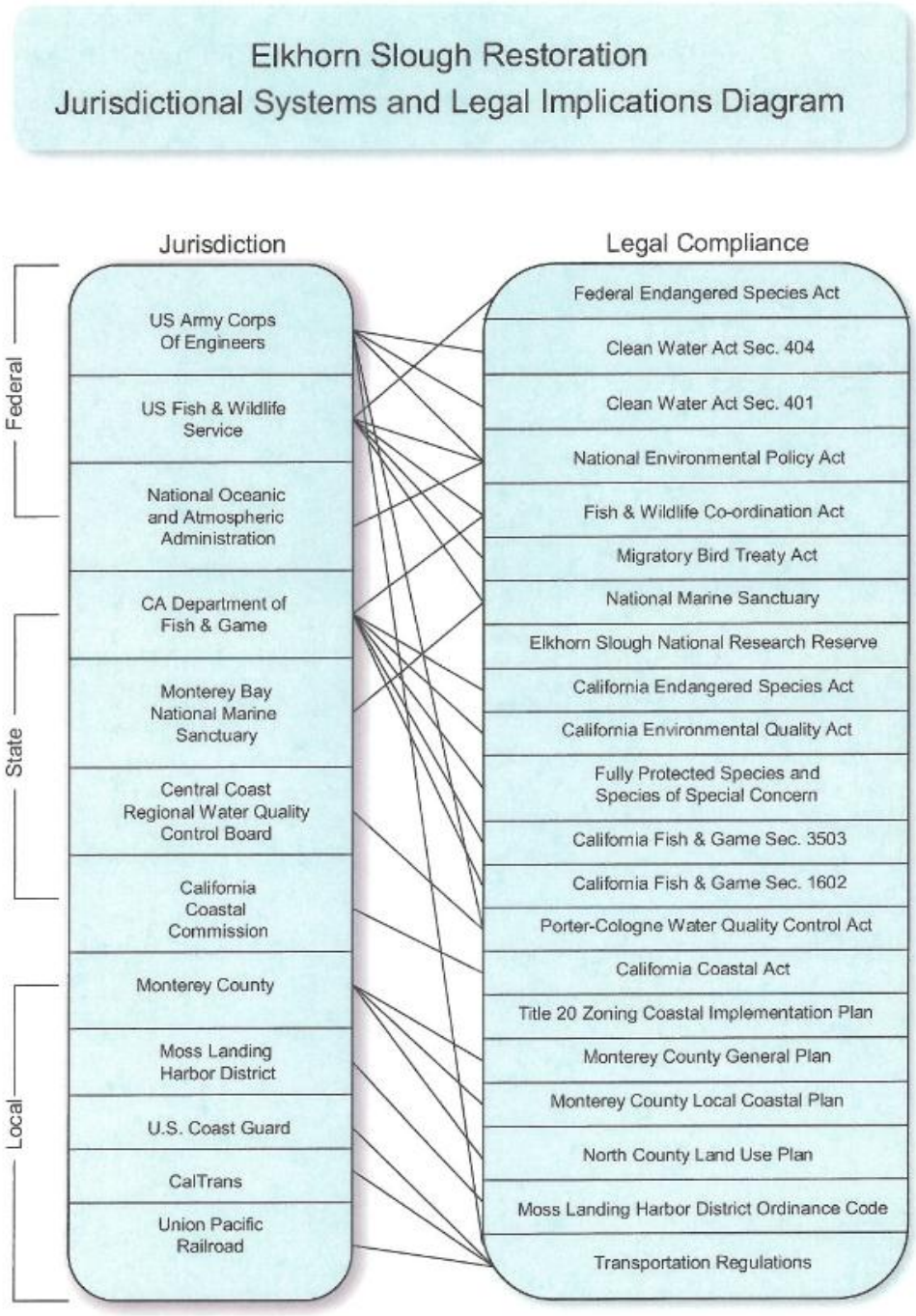
activities may have an effect on the water flow and quality between the sanctuary waters and the wetlands. MBNMS has a set of guidelines to conduct research and restoration activities within sanctuary boundaries. Permits may be issued by the Superintendent, MBNMS under special circumstances for activities otherwise prohibited by Sanctuary regulations when related to: 1) research to enhance scientific understanding of the Sanctuary environment or to improve management decision-making; 2) education to further public awareness, understanding, in order to establish access, use, and/or understanding of Sanctuary resources and wise use of the Sanctuary environment.

ESNERR encompasses about 1400 acres on the south and east side of Elkhorn Slough under the jurisdiction of California Department of Fish and Game (CDFG). One of the big threats to the Elkhorn Slough is the degraded Slough habitat. The Reserve facilitates and encourages research on many topics, one of large importance; restoration ecology of degraded Slough tidal habitats. A permit is required for any research done within Elkhorn Slough Reserve.

### *Federal – State Agency Interaction*

Pursuant to regulations adopted by the Office of Ocean and Coastal Resource Management (OCRM) under the Federal Coastal Zone Management Act, applicants for Corps Section 404 and Section 10 permits must include in their application a certification of consistency with the California Coastal Management Program under the auspices of the Federal Office of OCRM. This certification, and accompanying data and analysis, must also be submitted to the CCC, as the lead agency for California's CZM program, for review and concurrence. The Corps may not issue their permit until the CCC reviews and concurs with the applicant's consistency certification. This requirement is in addition to any other requirements the CCC has for coastal development permit applications. Therefore, following state laws and CCC rulings are prerequisites to obtaining Corps permits.

Pursuant to the Fish and Wildlife Coordination Act, the Corps must also give full consideration to comments submitted by the CDFG. It is obligated to comment on Corps permit decisions in order to ensure protection of the State's natural resources. In commenting on Corps permits, the CDFG coordinates with the policy direction of the California Coastal Act, the California Endangered Species Act, the California Environmental Quality Act, and other relevant State laws, administered by two other state agencies (see figure 20).




*Source: NOEP*

**Figure 20 Jurisdictional systems and legal implications**

### *State Government – Reporting and Permitting Agencies*

As with the federal government process, once the lead agency(s) is chosen and a restoration plan is developed for submission, an EIR is prepared, which is required by the state of California and implemented by any California agency. In response to the National Environmental Protection Act (NEPA), the California State Assembly created the Assembly Select Committee on Environmental Quality to study the possibility of supplementing NEPA through state law. This legislative committee, in 1970, issued a report entitled *The Environmental Bill of Rights*, which called for a California counterpart to NEPA. Later that same year, acting on the recommendations of the select committee, the legislature passed, and the governor signed, the CEQA statute.

In order to file for Corps permits, a Coastal Development Permit from the CCC is required. The CCC is charged with regulating development in California's coastal zone as stipulated in the California Coastal Act (CCC). Sections 30230, 30231, 30233, 30236, and 30240 are directly applicable to the preservation and protection of wetlands and other environmentally sensitive areas (CCC). Development or alteration of California's coastal wetlands is primarily regulated by Section 30233(a) of the Coastal Act, which mandates that restoration projects use the least environmentally damaging alternative and provide mitigation measures.

The second permit required in order to file for Corps permits is a Water Quality Certification, which is issued by the State Water Quality Control Boards. Elkhorn Slough falls under the Central Coast Regional Water Quality Board. The Board's primary role is to enforce the federal Clean Water Act, and in doing so, assert regulatory authority over development activities affecting the water quality of navigable water and wetlands, under Section 401(a)(1) as well as section 404 of the Clean Water Act.

Water Quality Certification will play a major role in the potential restoration activities because some actions proposed will require adding large amounts of silt to Elkhorn Slough. Water quality also becomes an issue because some proposed actions would reduce tidal flow, thereby probably increasing nutrient levels, which are already at nationally high levels (Caffrey). With reduced tidal flow and additional silt being introduced into the Slough, potential water quality issues could be compounded and water quality compromised.

Besides playing a managerial role in the ESNERR, CDFG has a multitude of other roles in the regulation of wetlands and permitting of restoration activities. In addition to being responsible for the maintenance and protection of California's fish and wildlife, the CDFG has authorities under California's Public Resources Code and the federal Fish and Wildlife Coordination Act to regulate or comment on activities in wetland and riparian areas (CCC). As mentioned earlier, the CDFG is obligated to comment on Corps permit decisions.

### *Local Government Jurisdiction/Permitting/Regulatory Bodies*

On the local level, there are multiple agencies and districts that have jurisdiction and/or permitting authority along with private interests (figure 21). As part of the California Coastal Act, local governments are delegated authorities from the CCC over coastal development (CCC). To meet the objectives of Section 30004(a) of the Coastal Act, the 73 cities and counties lying within the coastal zone prepare a LCP for CCC review and certification (CCC), which is a two-

tiered system: local coastal plan and local implementation plan. The applicant needs both before receiving authority (see the section on CCC for further explanation). Even though the CCC retains regulatory authority over the wetlands within the coastal zone, it gives local governments the ability to regulate wetlands within their jurisdiction.

In the case of Elkhorn Slough, Monterey County's LCP applies since the Slough is not under any city or town jurisdiction. It was approved in 1982 and gives Monterey County authority to permit within the coastal zone. Incorporated into the LCP is the North County Land Use Plan. In this plan, there are a number of policies relevant to restoration at Elkhorn Slough. Section 2.3.1 stresses that the North County areas are unique, limited, and fragile, and because these areas are important for the enrichment of present and future generations, they should be protected, maintained, and enhanced where possible (LCP).

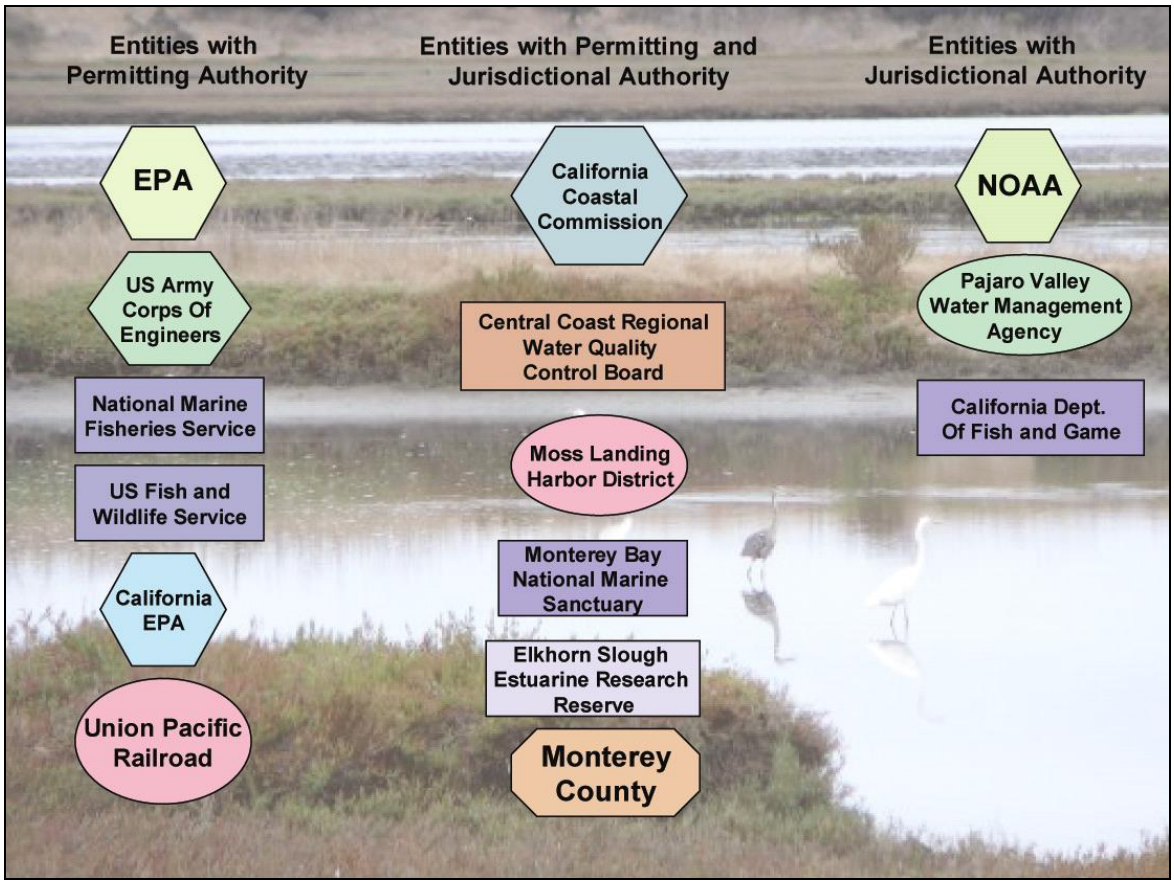



**Figure 21 Overview of entities with permitting and jurisdictional authority**

The North County Land Use Plan recommends developing a comprehensive wetland management program for Elkhorn Slough, specifically the upper end. The plan also recognizes that diking, dredging, and filling play valuable roles in wetland management, but only if an equivalent area of new or degraded wetlands within the same estuarine system is created or restored in a manner that maintains or enhances overall biological productivity (LCP). The plan also states that diking, dredging, or filling in Elkhorn Slough should maintain or enhance the biological productivity of the wetlands and that any alteration of the coastal estuary should be

limited to restorative measures and appropriate facilities associated with access, research, education, and aquaculture according to specific criteria designated in a wetland management plan. In order to get permits to conduct restoration activities in the coastal zone from Monterey County, the actions taken must demonstrate a parallel vision with the North County Land Use Plan.

Another local jurisdiction that affects Elkhorn Slough is the MLHD. It is governed by a five-member board that is elected at-large to four-year terms by voters within the MLHD. Board members establish all policies for the MLHD. According to the Monterey County Planning Department, the MLHD uses the North County Land Use Plan to guide some of its policies (MLHD, pg. 7). The MLHD is authorized by the California Harbor and Navigation Code, to require permits for various activities within the harbor, such as wetland development and restoration activities. MLHD construction permits are similar to a local agency Use Permit and are subject to Environmental Review under CEQA (MLHD, pg. 7). An additional concern, indicated by Lynda McIntyre, Harbor Master for Moss Landing, is that Moss Landing Harbor is a "Safe Harbor", one of three in California. Anything that could disrupt the natural tide and wave patterns and the ability of ships to come and go into this harbor for emergency would not be acceptable.

One agency with jurisdiction that overlaps Elkhorn Slough watershed lands is the Pajaro Valley Management Agency. This agency is chartered by the state and its role is "to efficiently and economically manage existing and supplemental water supplies in order to prevent further increase in, and to accomplish continuing reduction of, long-term overdraft and to provide and insure sufficient water supplies for present and anticipated needs within the boundaries of the agency. It is anticipated that long-term overdraft problems may not be solved unless supplemental water supplies are provided. The water management agency should, in an efficient and economically feasible manner, utilize supplemental water and available underground storage and should manage the groundwater supplies to meet the future needs of the basin. Though this agency does not have permitting authority over restoration activities in Elkhorn Slough, the potential impacts of restoration activities on groundwater supplies needs to be taken into account when deciding on a final Tidal Wetland Plan.

There are local interests involved in any potential restoration plan in parts of Elkhorn Slough that are not political or regulatory agencies. Union Pacific Railroad has a line that goes through part of Elkhorn Slough that could be affected by some of the potential restoration activities explained earlier. For instance, adding water control structures under the current opening of the railroad bridge at the mouth of Parson Slough is one potential option. It is likely that a written agreement will be needed between Union Pacific Railroad and the lead agency to implement restoration activities and gain access to private property.

Additional local interests or stakeholders may include adjacent locales such as Watsonville, Santa Cruz County, unincorporated Elkhorn, unincorporated Moss Landing, and areas in and around Castroville. Depending on the chosen course of action, the Monterey County Public Works, County Planning and Building Inspection Department may become involved with permitting.

# 4 The Economic Methodology and Approach

Just as the Slough has changed over time, the economy is expected to continue to evolve, with or without restoration, as the hydrology, habitat, and ecology of the Slough continue to change. There are a number of ways in which physical, ecological, and environmental change in the Slough could affect the local human uses, and thus the economy, of Moss Landing and Elkhorn Slough. Four primary factors that should be considered are: 1) habitat change (including change in open water); 2) change in connectivity between the Slough and Moss Landing; 3) changes in sediment delivery, erosion, and accretion; and 4) changes in water quality (fecal bacteria, nutrients, pollutants, dissolved oxygen, and salinity) in the estuary and nearshore environment. In addition, access to Slough areas and Moss Landing are obviously important for economic activity to take place in the area. The effects of restoration on Slough conditions are reviewed in detail by PWA (2008). The effects of these changes on key species are examined in greater detail by a series of reports prepared as part of the consideration of restoration alternatives. We will not repeat the findings of PWA and the species assessments in detail, but will highlight the links between a) projected physical and engineering changes (especially the four key estuary conditions above); b) economically important attributes of the Slough (e.g. key species access, and environmental quality); and c) economic activity (Figure 22).

This section delves deeper into the way in which the ecological, environmental, and physical conditions of the Slough may be linked to five important economic activities: a) commercial fishing; b) charter boat fishing; c) outdoor recreation and tourism; d) harbor activities; and e) power plant operations. Specifically, it considers how human and economic uses depend upon, and are affected by, ecological and environmental conditions in the Slough.

Chapter 6 examines three restoration alternatives and the No Action alternative to discuss the possible impacts of these alternatives on economic activities. Using predicted physical changes in the Slough (from the key species reports and the PWA assessment prepared for this effort), the relative orders of magnitude of change that could be expected in these activities under each scenario are discussed. In addition to providing a comparison of alternatives, attention is drawn to areas in which further, possibly original, research ought to be conducted to better understand the economic consequences of the alternatives.

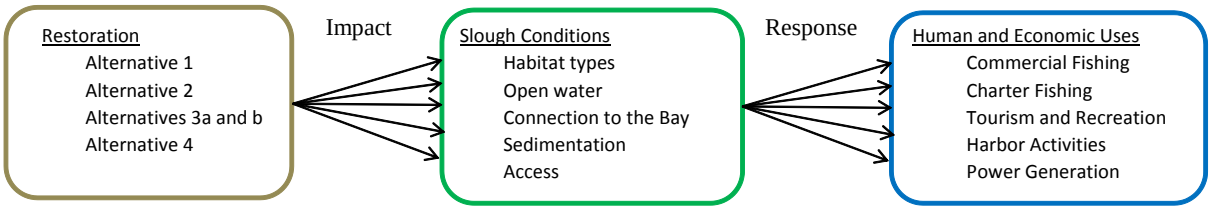



**Figure 22 Linking restorations to human uses - a framework**

## *4.1 The Economic Value of Estuary Conditions*

While there are a variety of studies in the literature that attempt to capture the economic value of wetlands (e.g. Woodward and Wui 2001 provide a review of U.S. wetlands valuation studies,

Kazmierczak 2001a and b provides values per acre for habitat protection, Costanza 1997 and Schuyt and Brander 2004 provide estimates for a variety of services), most of these focus on freshwater wetland values and none could be considered comparable to Elkhorn Slough, largely due to the rarity of such estuaries along the California coast. It is also worth noting that a recent study by the Ramsar Convention Secretariat (DeGroot et al. 2006) did not include a single estuary valuation example from the United States. Because of the scarcity of data about the economic values associated with estuaries like the Elkhorn Slough, this section draws on the literature on economic values when appropriate, but also including a discussion of the economic data collected for human uses of the Elkhorn Slough and Moss Landing areas.

### 4.1.1 Commercial Fishing

Brown et al. (2007) reports that Elkhorn Slough provides Essential Fish Habitat (EFH) for six species of flatfish: California halibut (*Paralichthys californicus*), English sole (*Pleuronectes vetulus*), starry flounder (*Platichthys stellatus*), California tonguefish (*Symphurus atricauda*), diamond turbot *(Pleuronichthys guttulatus*), and speckled sanddab (*Citharichthys stigmaeus*). Brown (2002) reports that at least five of these species are found commonly throughout the Slough (in this case, in five of nine areas sampled) and three species (California halibut, starry flounder, and speckled sanddab) were found in seven of nine areas surveyed (table 7). Three of these species (California halibut, English sole, and starry flounder) are caught commercially in local waters.

**Table 7 Flatfish species common to Elkhorn Slough**

| Category | Type | Common | Very Common |
|---|---|---|---|
| **Commercially Harvested** | California halibut | Yes | Yes |
| | English sole | Yes | No |
| | starry flounder | Yes | Yes |
| **Important Forage** | diamond turbot | Yes | No |
| | speckled sand dab | Yes | Yes |

According to data from the California Department of Fish and Game (CDFG), both the catch and value of California halibut, English sole, and starry flounder have varied substantially over the last three decades (Figure with a high landed value of $400,000 in 1997, but with significantly lower landed values for more recent years (just over $200,000 in 2004 and 2005 and just over $170,000 in 2006). Even in 1997, one of the best fishing years in recent history, the value of these three flatfish species accounted for roughly 10 percent of the total gross revenues from commercial fish landed in the port of Moss Landing. While California halibut, English sole, and starry flounder are an increasingly larger share of the value landed of all commercial flatfish in Moss Landing, they still account for less than 40 percent of the value of all flatfish landed by commercial vessels (Figure Other flatfish landed include dover, petrale, and rex sole and unspecified varieties of flounder, among others. Of course, not all flatfish landed in Moss Landing are caught near the Slough and so not all of these flatfish revenues, even for the three species highlighted here, can be assumed to be dependent upon Slough conditions.

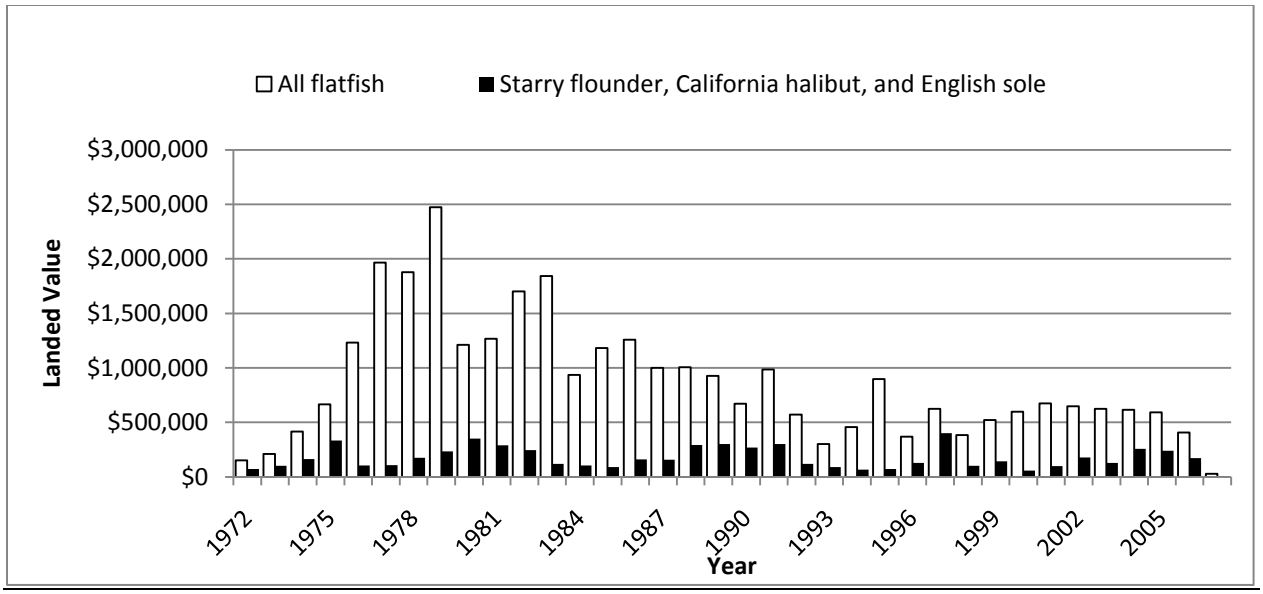



**Figure 23 Annual landed value of all flatfish and three possibly Slough-dependent flatfish species landed in Moss Landing (all blocks)**

### *Estuary Conditions and Commercial Fishing*

Brown et al. (2007) provides a detailed examination of the many ways in which key species of flatfish depend upon ecological and environmental conditions within the Slough. (Also see Norris 2006 for a review of the literature.) Despite numerous studies on flatfish in the Slough, it is unclear how the population of flatfish using the Slough at any point in time has changed as a result of physical changes in the Slough. Several studies show that flatfish assemblages have declined in many parts of the Slough, with abundances at Dairy, Kirby Park and Long Canyon sites in 1995-1996 greatly less than those documented during surveys between 1974-1980 and surveys in 1991-1992 (Yoklavich et al. 2002 cited in Brown et al. 2007). The abundance of speckled sanddabs, an important forage fish, also declined at surveys in the Bridge site while Starry flounder (a commercially important species) were shown to be formerly common in Elkhorn and Bennett Sloughs during the 1970s and 1980s but were no longer abundant by the end of the century (Yoklavich et al. 2002). At the same time, creel surveys of recreational anglers indicated that flatfish were being caught with greater frequency near the mouth of the Slough (Brown et al.2007).

Estuaries provide nursery habitat for California halibut, diamond turbot, starry flounder, and English Sole (Brown et al. 2007). While most nursery habitat (85%) for flatfish occurs along exposed coastline, 69 percent (2003) to 58 percent (2004) of 0-group halibut (halibut less than one year old) were found in protected embayments with juvenile halibut generally concentrated in shallow, warm-water, highly saline habitats (Fodrie and Mendoza 2006 cited in Brown et al.2007). Estuarine habitats are particularly important nursery habitat for English sole; in central California 45 percent to 57 percent of adult English sole came from recruits that used estuarine habitats even though estuaries comprise much less than 50 percent of the available juvenile habitat in central California (Brown 2006 cited in Brown et al. 2007). Within Elkhorn Slough,

English sole may be limited by thermal, depth, and salinity tolerances to deeper water habitats (Yoklavich et al. 1991, Baxter et al. 1999, and Brown 2006 cited in Brown et al. 2007).

### *Water Quality and Commercial Fishing*

The literature documents the sensitivity of flatfish to a number of water quality conditions including contamination (LeBlanc and Bain 1997, Allen et al. 1999, and Allen 2006, cited in Brown et al. 2007) and low levels of dissolved oxygen (known as hypoxia). Norris 2006 reviews the literature on the relationship between hypoxia and flatfish health and finds that even a small number of hypoxic days can result in detectable levels of morbidity and mortality among juvenile flatfish (Table 8).

**Table 8 Selected studies on hypoxia and flatfish**

| Level | Duration | Associated Effect | Author |
|---|---|---|---|
| **≤.0 ≥2 mg/L** | | | NOAA 1999 |
| **2.0 mg/L** | | Shift in species | Powers et al. 2005 |
| **2.0 mg/L** | Prolonged | Decline in benthic macroinvertabrates | Josefson and Widbom 1988, Nordberg et al. 2001 |
| **2mg/L** | | Direct mortality, migration, increased susceptibility to predation, altered life cycles. | Rabalais and Turner 2001 |
| **2 mg/L** | | | Dauer 1992 |
| **2 mg/L** | | | Diaz and Rosenberger 1995 |
| **2 mg/L** | | Various harmful effects | Tyson and Pearson 1991 |
| **2 mg/L** | | Various harmful effects | Diaz et al.1992 |
| **2 mg/L** | | Various harmful effects | Sagasti et al.2003 |
| **> 2 ≤ 5 mg/L** | | Biological stress | NOAA 1999 |
| **3.2 mgl/L** | 24 h | Juvenile and adult survival rate of 95% (min. allowable conditions derived from 12 invert and 11 fish species) | EPA 2002 |
| **4.8 mg/L** | 24 h | Growth reduced by 25% (min. allowable conditions derived from 7 invert and 4 fish species) | EPA 2002 |

To test whether hypoxic conditions could indeed have an impact on the commercial harvest of flatfish species in Moss Landing, Scott Norris worked with the team to examine historical data for dissolved oxygen and the commercial catch of the three flatfish species shown to be both common within the Slough and commercially important (California halibut, English sole, and starry flounder).

Data on dissolved oxygen were taken from the historical time series of dissolved oxygen monitored at the South Marsh sampling station in the center of Elkhorn Slough (Figure 24). From these data, Norris determined the number of days for which dissolved oxygen levels were below a given threshold (2.0 mg/L, 3.0 mg/L, and 4.8 mg/L) for more than 12 or 24 consecutive hours (Table 9). The data show that the numbers of severely hypoxic days (O2 ≤3.0mg/L) at the South Marsh monitoring station have been few over the last ten years, but the number of days of moderate hypoxia ($O_2 \leq 4.8$mg/L) have been more numerous. An EPA study (EPA 2002) found that even moderate hypoxia could affect the growth rates of flatfish if hypoxic conditions occur

for at least twenty-four hours. For the purposes of statistical analysis, there is not sufficient variation in number of days with extended severe hypoxia. So, the effect on fish catch of the number of days for which moderate hypoxia occurred for at least twenty-four hours was examined.

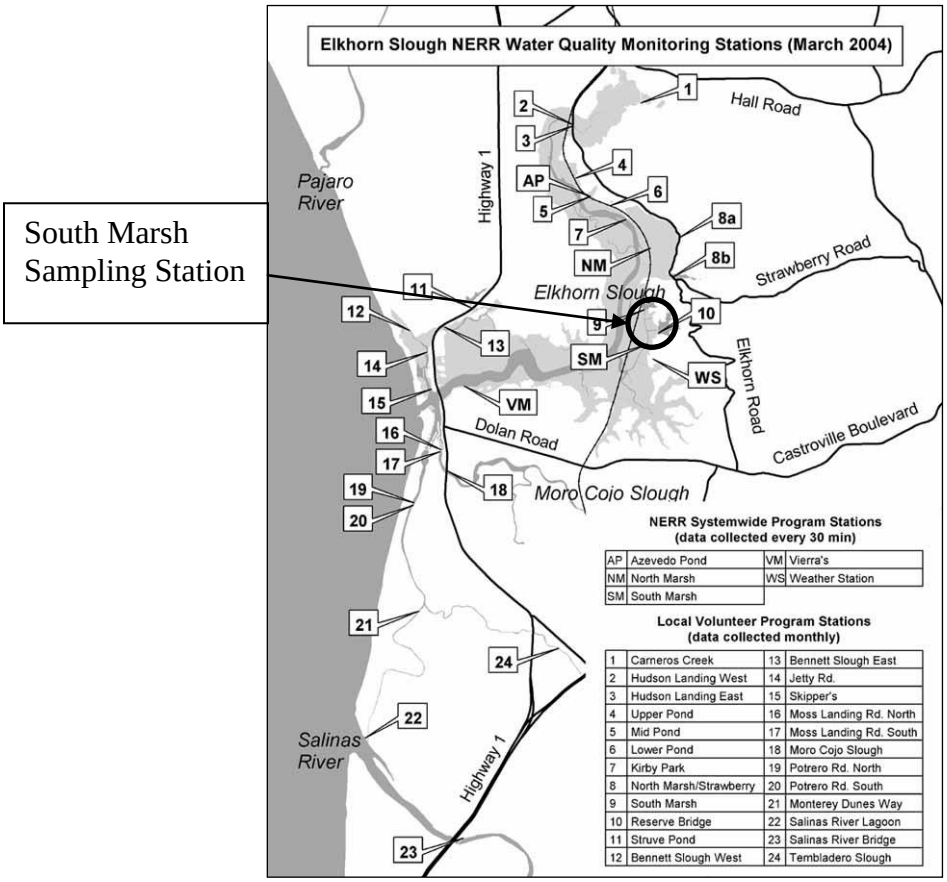



**Figure 24 Water quality monitoring stations in Elkhorn Slough**

**Table 9 Hypoxia occurrences at the South Marsh Monitoring Station, Elkhorn Slough**

| Year | ≤2.0mg/L | | ≤3.0mg/L | | ≤4.8 mg/L | |
|---|---|---|---|---|---|---|
| Duration (hours) | 12 | 24 | 12 | 24 | 12 | 24 |
| 1996 | 7 | 4 | 8 | 3 | 10 | 5 |
| 1997 | 0 | 0 | 1 | 0 | 5 | 2 |
| 1998 | n/a | n/a | n/a | n/a | n/a | n/a |
| 1999 | 0 | 0 | 0 | 0 | 12 | 4 |
| 2000 | 0 | 0 | 0 | 0 | 3 | 1 |
| 2001 | 0 | 0 | 5 | 0 | 26 | 4 |
| 2002 | 0 | 0 | 0 | 0 | 8 | 0 |
| 2003 | 0 | 0 | 0 | 0 | 9 | 0 |
| 2004 | 0 | 0 | 0 | 0 | 5 | 0 |
| 2005 | 0 | 0 | 0 | 0 | 19 | 4 |
| 2006 | 0 | 0 | 1 | 1 | 12 | 3 |

As mentioned above, it is not likely that all flatfish landed in the port of Moss Landing spend some part of their life history in the Slough. To narrow the focus on the potential effect of Slough conditions on commercial fish catch, focus was placed on the three species identified as being common in the Slough and commercially important (California halibut, English sole, and starry flounder) were considered only on fish caught in the nineteen CDFG blocks located near the mouth of the Slough (Figure Landed weight of these species and the average mean El Nino Index data are available for 1996-2007 (
Table 11).

To explore the relationship between hypoxia and commercial fish catch, a simple linear regression model is offered. The findings are only preliminary, and substantially constrained by only a few years of data. A longer time series of data would allow for a more careful time series analysis. The results of the model should be interpreted as multivariate correlation.

The simple model assumes that the aggregate commercial landings of California halibut, English sole, and starry flounder, caught in the nineteen CDFG fishing blocks nearest to Moss Landing, may be influenced by the degree of hypoxia in Elkhorn Slough. Since there is a time lag between when fish are of juvenile size and when they are large enough to be harvested commercially, the effect of hypoxia on commercial landings from these blocks, two years after the occurrence of hypoxia was examined. In other words, the effect of hypoxia in year *t* on commercial landings in year *t+2* was modeled. Further, Brown et al. (2007) suggests that El Niño conditions may be related to increases in the abundance of halibut found in San Francisco Bay. To control for El Niño related factors are an important determinant of commercial landings for these three species, a measure of Mean El Niño conditions (the MEI) is included in the analysis as calculated by Klaus Wolter of NOAA.[5] The formal model is

$$\text{Landings}_t = \alpha + \beta\,(\#\text{ hypoxic days})_{t-2} + \delta(\text{MEI})_t + \varepsilon$$

where $\text{Landings}_t$ refers to the landed weight of California halibut, English sole, and starry flounder caught in the nineteen nearest blocks to Moss Landing and landed in Moss Landing, $\alpha$ is a constant, $\beta$ is the coefficient on the number of hypoxic days (number of days for which dissolved oxygen levels were less than 4.8 mg/L for twenty-four hours or more, two years prior), $\delta$ is the coefficient on the Mean El Niño Index (MEI), $\varepsilon$ is the estimation error term, and the subscript *t* refers to the year. The null hypothesis tested is $\beta = 0$. In other words, hypoxia in the Slough is not discernibly correlated with catch of the three species from the nineteen nearest fishing blocks. The estimation of the model (
Table 10) reveals that the occurrence of hypoxia in the Slough has been associated with declines in commercial landings of these species two years later. The results also show that El Niño effects are important and the effect of El Niño on these three species of flatfish is in the direction opined by Brown et al. (2007) for halibut. Both correlations are highly significant. The results suggest that over the period examined, each additional day of hypoxia has been associated with a decline in catch (from these blocks for these species) of over 7,000 pounds. Of course, many other factors are likely to be important in determining catch for these species. To put these changes in context, flatfish of these same species landed in Moss Landing and caught in all

[5] See http://www.cdc.noaa.gov/people/klaus.wolter/MEI/ for additional information.

CDFG blocks were also examined. A statistically significant relationship was not found between hypoxia and catch when all blocks were considered (coefficient = -4,929, p value = .30), suggesting that the phenomenon was limited to these flatfish caught near the Slough. While limited, these initial results indicate that hypoxia in the Slough could be an important concern for local commercial flatfish catch.

**Table 10 Estimation results - factors affecting flatfish catch near Elkhorn Slough**

| Landings | Coefficients | P-value |
|---|---|---|
| Intercept | 40,249 | 0.0004 |
| MEI | 25,589 | 0.022 |
| Hypoxic Days 2 years prior | -7,706 | 0.012 |

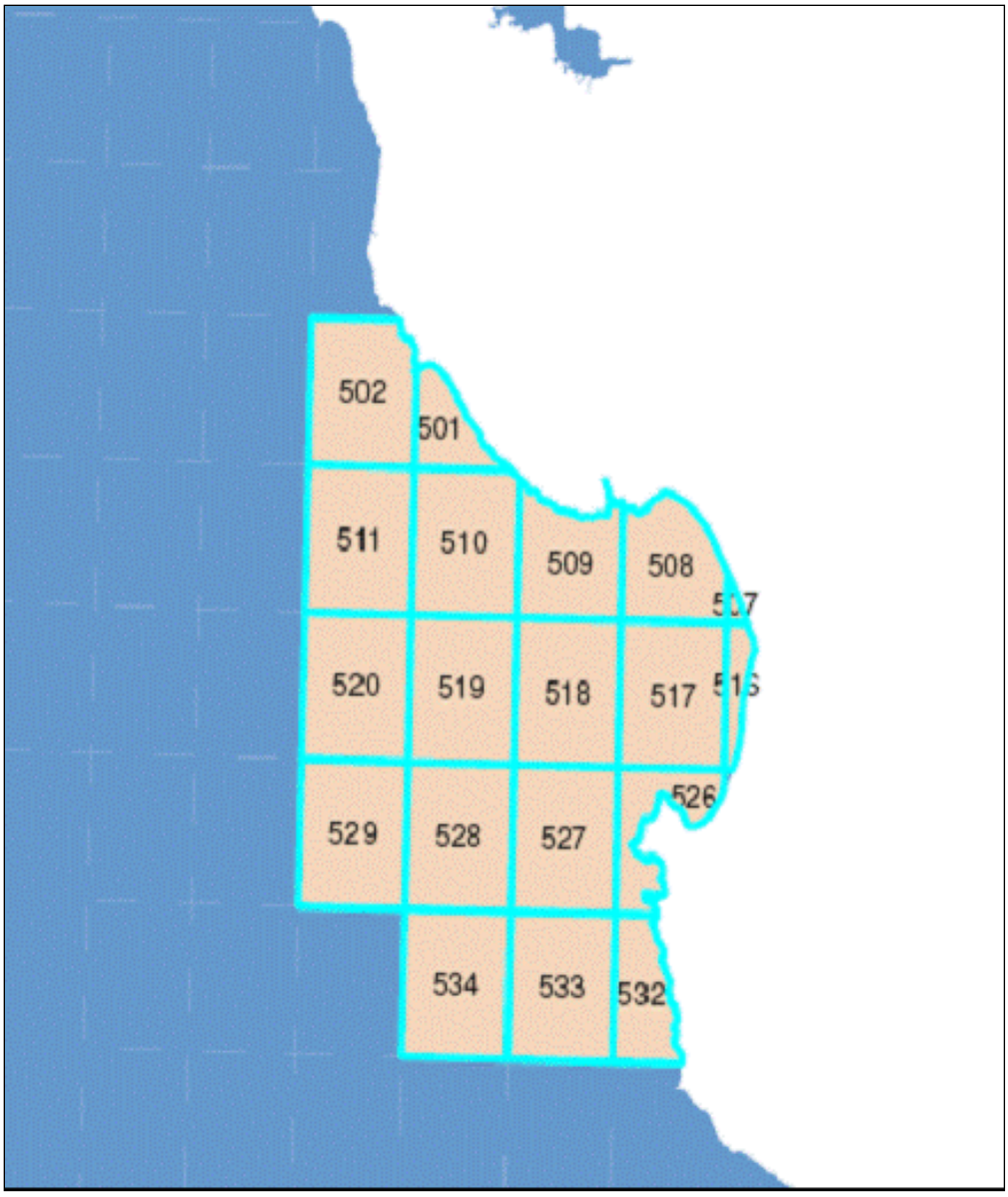



**Figure 25 CDFG fishing blocks near the mouth of Elkhorn Slough**

**Table 11 Landed weight of California halibut, English sole, and starry flounder**

| | Landed weight (pounds) | Average Mean El Niño Index | # Days, $O_2$≤4.8mg/L (≥24 hours, 2 years prior) |
|---|---|---|---|
| **1996** | 31,157 | 1.494 | n/a |
| **1997** | 44,439 | 0.848 | |
| **1998** | 9,852 | -0.863 | 5 |
| **1999** | 9,502 | -0.521 | 2 |
| **2000** | 5,354 | -0.180 | 0 |
| **2001** | 10,011 | 0.589 | 4 |
| **2002** | 32,246 | 0.461 | 1 |
| **2003** | 34,036 | 0.432 | 4 |
| **2004** | 65,980 | 0.298 | 0 |

| | | | |
|---|---|---|---|
| **2005** | 53,463 | 0.326 | 0 |
| **2006** | 54,633 | -0.266 | 0 |
| **2007** | 2016 | 1.494 | 4 |

Brown et al. (2007) reports that recent research by Ritter et al. (in press) found that flatfish are more common in Elkhorn Slough in sites with full tidal exchange than ones behind water control structures. Flatfish were absent from tidally restricted sites and less common in sites with moderate exchange through water control structures (Ritter et al. in press in Brown et al.2007). In the Parsons Slough complex, reduced tidal exchange may have played a decline in flatfish populations there, even though more flatfish habitat was created by the restoration Brown et al. (2007) (Figure

Finally, while flatfish appear to benefit from tidal flushing and the deep-water habitats that have increased in the Slough since the opening of Moss Landing harbor, other estuary fish depend importantly on salt marsh (Griffith 2008). These other estuarine fish, however, are not currently an important part of the commercial harvest.

### 4.1.2 Commercial Passenger Fishing Vessels

As noted by Brown et al. (2007) and others (Leet et al. 2001) recreational anglers, including charter boat anglers, often target flatfish. Over the last ten years, however, the number of flatfish caught by anglers on CPFV leaving from Moss Landing have been few (Figure and have never represented more than 0.8 percent of total catch (measured as number of fish caught and kept) by charter boat anglers. During the same period, salmon and rockfish have represented the vast majority of species caught by party boat anglers, but the total number of these species caught has declined during this time. Salmon catch has declined particularly sharply in the last two years.

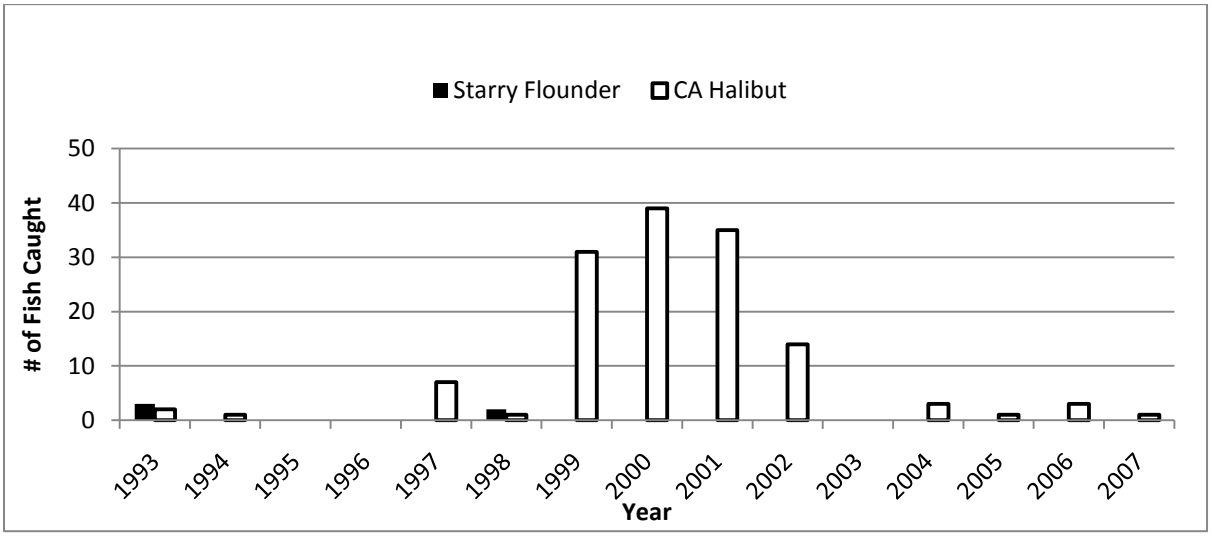



**Figure 26 Annual catch of starry flounder and California halibut by CPFV anglers**

### 4.1.3 Outdoor Recreation and Tourism

A variety of types of outdoor recreation and tourism could be affected by ecological, environmental, and physical changes in the Slough. Bird watchers and wildlife viewers, especially otter watchers, may be affected if changes in Slough conditions lead to changes in the abundance and distribution of these species throughout the Slough. People who engage in paddlesports (e.g.kayakers and canoers) traverse more of the Slough and interact with more Slough environments than any other types of users. Recreational fishers frequent a variety of sub-tidal habitats within the Slough, in Moss Landing, and even the nearshore beaches.

To learn more about who visits the Slough and how their visits are influenced by environmental and ecological conditions, the Elkhorn Slough Tidal Wetland Project assisted by conducting randomized surveys of 308 Slough visitors and others recreating in the Moss Landing area during the summer of 2008.[6] The findings reveal that most visitors to the area come to participate in some form of outdoor recreation, with 57 percent of all visitors surveyed reporting that watching wildlife was an important reason for their visit and 41 percent specifically identifying birding as an important activity (Table 12). Hiking (42%), kayaking (26%), and beach going (27%) are other outdoor activities that are important to local visitors. Most visitors to the Slough are day-trippers. The median stay at the Slough is one day or less with an average length of stay of 1.6 days. The length of stay does not differ statistically among the different type of users. Overall, Slough visitors are an avid group of users making nineteen trips per year. Birdwatchers were the most frequent visitors making twenty-one trips to the Slough each year (Table 13).

**Table 12 Important reasons for visiting Elkhorn Slough/Moss Landing**

| Activity | Response Rate |
|---|---|
| Shopping | 5% |
| Kayaking | 26% |
| Beachgoing | 27% |
| Wildlife Viewing | 57% |
| Birding | 41% |
| Other | 19% |
| Fishing in Slough | 9% |
| Boating | 5% |
| Hiking | 42% |
| Looking at Fishing Boats | 7% |
| Surfing | 6% |
| Fishing in Ocean | 7% |
| Note, respondents can choose more than one reason. | |

[6] The survey was based on pre-tests conducted in 2007 working with NOEP staff.

**Table 13 Visitor participating in four specialized activities**

| Elkhorn Slough Visitation (per person/past 12 months) | | |
|---|---|---|
| | Mean annual visits | Median annual visits |
| Birding | 21.0 | 8 |
| Wildlife | 19.3 | 6 |
| All | 19.0 | 6 |
| Fishing | 18.5 | 6 |
| Kayaking | 18.2 | 6 |

As one of the largest estuaries on the California coast, Elkhorn Slough is home, nursery, and refuge to a variety of important and sometimes charismatic animal and plant species. At some point in the year as many as 300 different species of birds, including thirty-eight species of shorebirds (Senner and Howe 1984; Ramer, et al. 1991; Page et al. 1992), can be found at the Slough. Elkhorn Slough also is thought to provide habitat for >1 percent of the global population of threatened long-billed curlew populations, and >10 percent of the state's endangered, coastal-breeding population of western snowy plovers (Cooper 2004; Ruegg 2007). These bird species are an important draw for 41 percent of the respondents who said seeing birds was an important reason in their decision to visit the Slough.

Sea otters also are a species that is rare generally, but relatively abundant in Elkhorn Slough. In 1994, the mean number of otters observed per survey was 4.2 individuals (Kieckhefer et al. 2007). From 1994 to 2000, the otter population increased, then subsequently decreased until rising again in 2005. In 2006, consistently high counts resulted in an annual mean of 67.6 individuals with a record high count of 121 otters in November of 2007 (Kieckhefer et al. 2007). 72 percent of all of those interviewed said they hoped to see otters during their visit. Twenty-four percent of kayakers said that seeing a sea otter during their trip was an important reason for choosing to kayak in the Slough. Loomis's review of the literature finds some evidence that the presence of otters is associated with higher spending by tourists (Loomis 2006).

Visitors to the Slough spend money locally on food, lodging, bait and tackle and other items (median expenditures per group per trip was $18, median expenditure per person per trip was $7.5). From the perspective of local spending, however, not all visitors are created equal (Table 14). Aside from the rare few shoppers (5 percent listed shopping as in important reason to visit the Moss Landing area), those that came to the Slough specifically to kayak or go to the beach tend to spend the most money per trip (median expenditures of $60 and $30 per trip respectively), with those identifying wildlife viewing and birding as important reasons spending approximately $20 per trip (some of these wildlife viewers participate in guided tours), estuary anglers spending $17.50 per trip, hikers spending $15 per trip, and marine users spending very little (surfers reported spending a median of $2 per trip and recreational anglers reporting median expenditures of $0 per trip). Per person per day expenditures follow a similar pattern, although the amount spent is generally considerably smaller (Table 14).[7] Much of this spending supports local businesses including the Captain's Inn, the Slough Safari, numerous restaurants, and convenience stores.

As discussed earlier, expenditures (local spending) themselves do not represent economic value – a term that more closely represents the value of an activity beyond the costs of providing that activity. For businesses, economic value is most closely reflected by profits. Economic value, however, also accrues to the consumer – in this case the visitor to the Slough. Many visitors to the Slough are likely to enjoy a benefit well beyond what they pay to participate in that activity (see Pendleton 2008 for a review of the literature on the non-market value of coastal and estuary recreation). Forty-one percent of respondents reported that they did not spend any money locally during their visit. These values are enjoyed by all visitors, but local visitors (who face the lowest travel costs) enjoy the greatest benefits, all else being equal. Beach goers in California have been shown to have a willingness to pay that exceeds what they do pay by approximately $15 per trip (Pendleton and Kildow 2006). Other outdoor recreationists, especially saltwater anglers, are known to enjoy a willingness to pay per trip that is similar for shore-based anglers ($10-$30 per person-day) and may be substantially higher for charter vessel anglers and fishers from private boats ($25-$100 per person-day) (Pendleton and Rooke 2006; Pendleton 2008). It is likely the case that the effects of restoration may have different impacts on expenditures and economic value, depending on the types of uses affected.

Visitors to the Slough and Moss Landing are not distributed evenly throughout the area. The NOEP team collaborated with Kerstin Wasson and other ESNERR staff to develop a map of regions within the Slough/Moss Landing area that could be differentially affected by restoration activities, then respondents were asked to relay where in the Slough and Moss Landing they went during their most recent trip to the Slough and what they did (Figure 27). Many of the areas of the Slough were rarely visited during the summer of 2008, with the most heavily visited sites being the more commercial and accessible areas of North and South Moss Landing (Table 15). Seventy-nine percent of all respondents visited Moss Landing North, South or the Bennett Slough areas. Fifty-two percent visited some part of the estuary itself (as defined as areas 4-15 on the map in Figure 27. Additionally, roughly 20 percent of all visitors went to each of the

[7] Note, both were asked about important reasons for visiting and whether a respondent participated in an activity. In all cases, expenditures by activity are higher for those who indicate the activity is an important reason for visiting compared to those who may have incidentally undertaken and activity.

following sites within the Slough: the ESNERR Visitors Center (22%), Kirby Park (21%), the Moss Landing Wildlife Area (20%), and the Seal Bend/Rubis Creek area (19%). Respondents who considered themselves Hispanic were most likely to visit Moss Landing South (60%), Moss Landing North (35%), or Kirby Park (20%) with less than 5 percent visiting each of the other sites listed in the survey. Clearly, access is an important determinant of where people go and restoration activities that affect access could have an impact on visitation to the area. The findings also suggest that many areas within the Slough could be altered substantially without a direct impact on many human uses (e.g. Bennett Slough, Morro Cojo Slough, North Marsh, Hudson's Landing, and Porter Marsh each host less than 2 percent of all respondents surveyed).

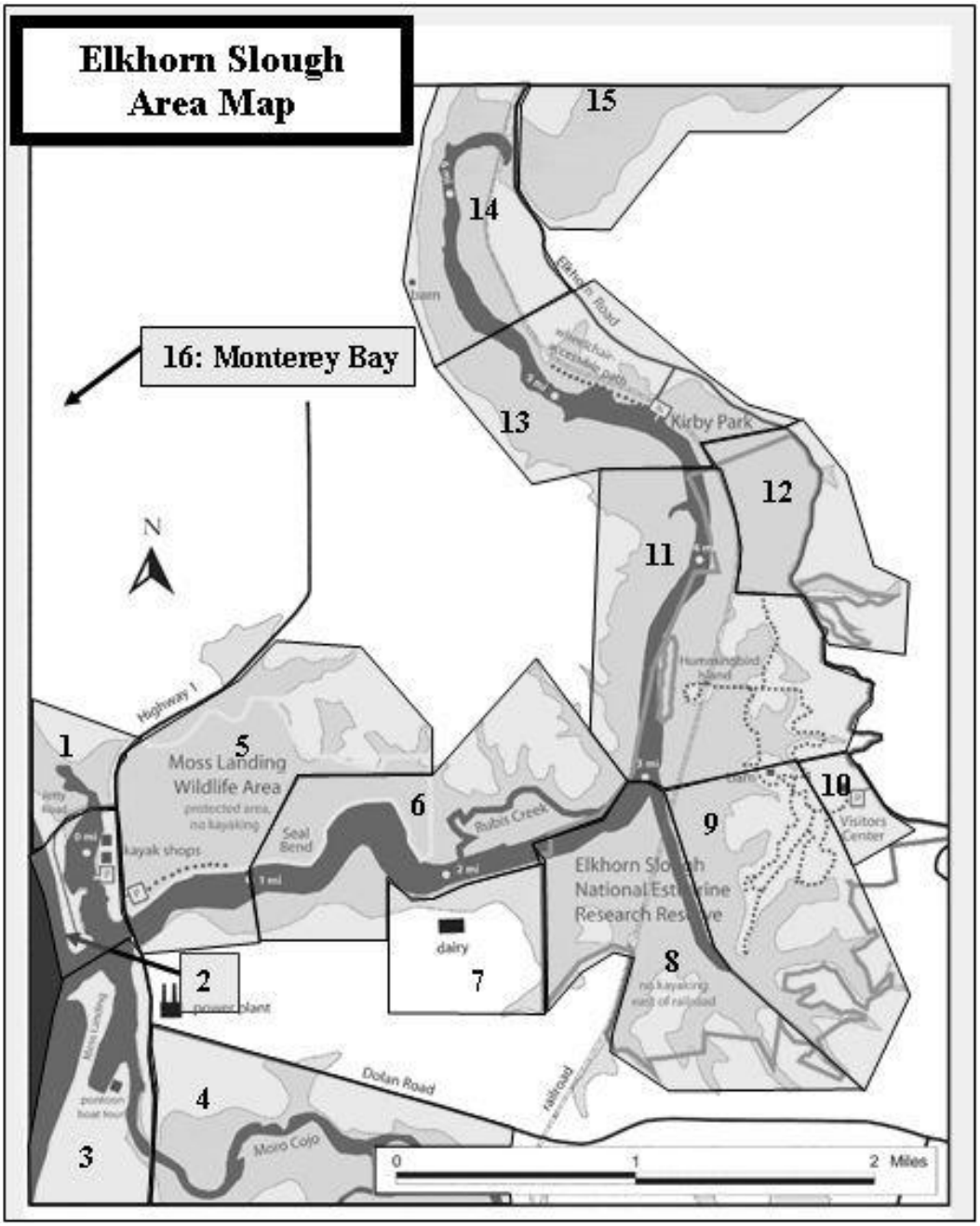



**Figure 27 Areas surveyed - Moss Landing and Elkhorn Slough**

**Table 14 Average expenditures in Elkhorn Slough categorized by reason for visiting**

| | Responses | Per Trip | Per Person Day |
|---|---|---|---|
| Shopping | 14 | 90 | 20 |
| Kayaking | 79 | 60 | 21 |
| Beachgoing | 82 | 30 | 10 |
| Wildlife Viewing | 175 | 22 | 10 |
| Birding | 125 | 20 | 10 |
| Other | 57 | 20 | 10 |
| Fishing in Slough | 28 | 17.5 | 6.7 |
| Boating | 16 | 17.5 | 2 |
| Hiking | 130 | 15 | 5 |
| Looking at Fish Boats | 22 | 15 | 10 |
| Surfing | 19 | 2 | 1 |
| Fishing in Ocean | 23 | 0 | 0 |
| All | 308 | 18 | 7.5 |
| Note: respondents can choose more than one reason | | | |

**Table 15 Respondents visiting each site on current trip by activity type**

| | Total | Hike/Walk | Wildlife Viewing | Fishing | Birding | Kayaking |
|---|---|---|---|---|---|---|
| 1. Bennet Slough | 2% | 1% | 1% | 0% | 1% | 0% |
| 2. Moss Landing North | 43% | 10% | 18% | 4% | 10% | 18% |
| 3. Moss Landing South | 46% | 23% | 16% | 5% | 6% | 2% |
| 4. Moro Cojo Slough | 2% | 1% | 0% | 0% | 0% | 0% |
| 5. CDFG ML Wildlife Area | 20% | 2% | 6% | 1% | 5% | 16% |
| 6. Seal Bend/Rubis Creek | 19% | 1% | 6% | 0% | 3% | 16% |
| 7. Moon Glow Dairy | 6% | 1% | 2% | 0% | 2% | 4% |
| 8. ESNERR South | 11% | 0% | 3% | 0% | 2% | 10% |
| 9. South Marsh | 11% | 10% | 8% | 0% | 6% | 1% |
| 10. Visitors Center | 22% | 19% | 11% | 0% | 8% | 0% |
| 11. ESNERR North | 15% | 6% | 6% | 0% | 4% | 9% |
| 12. North Marsh | 2% | 1% | 1% | 0% | 0% | 0% |
| 13. Kirby Park | 21% | 8% | 6% | 1% | 5% | 9% |
| 14. Hudson's Landing | 2% | 1% | 0% | 0% | 1% | 0% |
| 15. Porter Marsh | 1% | 0% | 0% | 0% | 0% | 0% |
| 16. Monterey Bay | 6% | 3% | 3% | 1% | 1% | 1% |

### *The Effects of Restoration on Outdoor Recreation and Tourism*

Changes in habitat, connectivity between the Slough and the Bay, sedimentation, and water quality all could affect outdoor tourism and recreation to the Slough and Moss Landing areas. To date, there is no empirical evidence that links changes in Slough conditions to changes in tourism and recreation[8]. In fact, there are no examples in the literature that demonstrate that changes in estuary conditions have caused changes in recreational uses of estuaries over time, but there are numerous "cross-sectional" studies that demonstrate that coastal recreationists and tourist prefer certain environmental and ecosystem attributes. For instance, recreational fishing success has been linked to environmental conditions (see Lipton and Hicks 2003; Lipton and Strand 1997). Beach values and attendance have been linked to fecal indicator bacteria (see for example Bockstael et al.1987; Bockstael et al.1989; Freeman 1995; Hayes et al.1992; Murray et al.2001; Smith et al.1997). Bird watchers and wildlife viewers are known to place a direct value on being able to see certain species (e.g. McCollum and Miller 1994 in Colt 2001; Johnston et al. 2002; Hoagland and Meeks 2000).

In the absence of data or other research that shows empirically how environmental change might affect recreational uses, an examination of where current recreational activities take place within the Slough and nearby Moss Landing areas was conducted. Also examined were the preferences for habitat types and water quality that were expressed by the respondents to the survey. These relationships are summarized in Table 18 and discussed in more detail below.

### *Habitat Changes and Recreation and Tourism*

The Slough currently is dominated by intertidal mudflats (1088 acres) and salt marsh (695 acres), with smaller proportions of the Slough in deep subtidal areas (345 acres) and shallow subtidal areas (209 acres, all figures from PWA 2008). Without serious intervention, it is predicted that salt marsh will continue to decline in cover, being replaced by intertidal mudflats. More deep subtidal area also will become available in the Slough.

The current assemblage of species within the Slough, and indeed current patterns of outdoor activity in the Slough, have evolved around this existing, albeit dynamic palette of habitat types. While much of the focus of restoration is on preventing continued loss of salt marsh habitat, it is not obvious from the distribution of visitors or their responses to survey questions that outdoor recreational activities currently undertaken in the area benefit directly from salt marsh habitat. Outdoor recreation is largely, but not entirely, concentrated in areas of the most marine influence (Moss Landing and the beaches) and Slough areas dominated by deep and shallow subtidal habitat, including those areas that have experienced the most marsh loss since the creation of the Moss Landing Harbor (e.g. areas 5, 8, and 13, see Table 15 and Table 16).

[8] Note: in our original work plan we hoped to collect an historic time series of recreational activities based on data provided by local businesses. As discussed above, these data were not made available and so we are unable to examine the effect of environmental change on these activities. Our intercept survey could serve as a tool to collect this kind of time series information.

**Table 16 Habitat types and areas visited**

| Mapped Areas | Percent Visitation | Species (C=common, R=rare, M=moderate) | Deep Subtidal | Shallow Subtidal | Intertidal Mudflat | Salt Marsh |
|---|---|---|---|---|---|---|
| 1. Bennet Slough | 2% | Shorebirds (C); otters (R); clams (R); flatfish (R) | Rare or Absent | Common | Common | Common |
| 2. Moss Landing North | 43% | Shorebirds (C); otters (C); clams (C); flatfish (M) | Common | Common | Common | Rare |
| 3. Moss Landing South | 46% | Shorebirds (M); otters (C); clams (C); flatfish (M) | Common | Common | Common | Common |
| 4. Moro Cojo Slough | 2% | Shorebirds (R); none of the rest present | Rare | Common | Rare | Common |
| 5. CDFG ML Wildlife Area | 20% | Shorebirds (M); otters (C); clams (C); flatfish (M) | Common | Common | Common | Common |
| 6. Seal Bend/Rubis Creek | 19% | Shorebirds (M); otters (C); clams (R); flatfish (M) | Rare | Common | Common | Common |
| 7. Moon Glow Dairy | 6% | Shorebirds (M); otters (C); clams (R); flatfish (M) | Rare | Common | Common | Common |
| 8. ESNERR South | 11% | Shorebirds (M); otters (R); clams (R); flatfish (M) | Rare | Common | Common | Common |
| 9. South Marsh | 11% | Shorebirds (M); otters (R); clams (R); flatfish (M) | Rare | Common | Common | Common |
| 10. Visitors Center | 22% | n/a | n/a | n/a | n/a | n/a |
| 11. ESNERR North | 15% | Shorebirds (M); otters (R); clams (R); flatfish (M) | Moderate | Common | Common | Common |
| 12. North Marsh | 2% | Shorebirds (M); flatfish (R) | Rare | Common | Rare | Rare |
| 13. Kirby Park | 21% | Shorebirds (M); otters (R); clams (R); flatfish (M) | Rare | Common | Common | Common |
| 14. Hudson's Landing | 2% | Shorebirds (M); otters (R); clams (R); flatfish (M) | Rare | Common | Common | Common |
| 15. Porter Marsh | 1% | Shorebirds (R); none of the rest present | Rare | Common | Rare | Common |
| 16. Monterey Bay | 6% | | | | | |

Wasson reviews and highlights the many interdependencies upon habitat types and bird species, otter prey, and fish species. The key species reviews highlight the many ways in which bird species, otter prey, and fish species depend upon specific estuary habitat types in the Slough. Many species that currently are important for outdoor recreation do not depend directly on salt marsh habitats or use salt marsh as secondary habitat. Shorebirds tend to benefit from shallow subtidal and intertidal habitats, but may take refuge and/or forage in salt marsh areas when mudflats are inundated. Otter prey also benefit from shallow subtidal and intertidal habitats as well as rocky intertidal habitat including that which could be created by new sills or jetties.

Flatfish species are targeted by more than half of all estuary anglers interviewed. According to Brown et al.2007, flatfish depend most importantly on deep water and intertidal mudflat areas, but not directly on salt marsh (also see Kramer 1990). None of the alternatives appear to directly threaten habitat types most important to economically important species, but the alternatives do differ in the degree to which additional acreage of these potentially beneficial habitat types are created (e.g. subtidal and intertidal habitats).

Kayakers show a strong preference for inundated areas of the Slough (Table 17). Obviously, kayakers need water deep enough to paddle and so they tend to prefer open water and tidal creek areas. Nevertheless, 40 percent of all kayakers interviewed said that kayaking near salt marsh areas was important to them. Of all recreational uses, kayaking is likely to benefit most from the addition of new salt marsh or the preservation of existing salt marsh areas.

**Table 17 Kayaking habitat type preferences**

| Site | Percent of Kayakers |
|---|---|
| Slough Open Water | 84% |
| Tidal Creeks | 49% |
| Salt Marsh | 40% |
| Open Ocean | 35% |
| Mud Flats | 23% |
| Oak Wood Lands | 15% |
| Chaparral Scrub | 11% |
| Ag Land | 9% |
| Other | 0% |

### *Sediments and Recreation and Tourism*

Related to the dynamism of habitat types in the Slough are the changing sources, volumes and distribution of sediments within the estuary. The distribution of bird species in the Slough is likely to depend on the abundance and coarseness of different types of sediments (see Ruegg (2007), who reviews findings by Ramer 1985; Connors 2003; Yates et al. 1993). Long-billed Curlews, Marbled Godwits and Willets appear to prefer coarser sediments, while Least Sandpipers are more often found in areas with finer-grained sediments (Conners 2003 in Ruegg 2007). It is difficult to know exactly how these sedimentary changes could affect birding activities in the Slough, but these impacts will be most important if sediment changes result in the loss of species locally or affect the ability of bird watchers to see important bird species from existing viewing and access sites. Similarly, the distribution of prey species favored by otters depends on the types of sediments available. While invertebrates are abundant in mudflats in the Slough, they are more difficult for otters to access in soft sediments as opposed to rocky

substrates (Laidre et al.2001). Otter viewing could be affected if otters move away from viewing areas because of changes in sediment.

Sediments are exchanged between the Slough and local beaches. In addition to beach sands depositing in the harbor, fluvial sediments from the Slough are carried into Monterey Bay and contribute to the sand budgets of local beaches. However, much of this sediment is finer-grained than beach sand and is likely lost to the Monterey Submarine Canyon (PWA 2008). Regardless, restoration alternatives that affect the exchange of sediments between the Slough and the local beaches could be important and should be investigated further, as Moss Landing State Beach and Salinas River State Beach provide important recreational opportunities for visitors to the Moss Landing area. Similarly, a new mouth for the Slough, as proposed in Alternative 2, could affect sediment budgets for Moss Landing State Beach, which would be bisected by the new inlet. Unless an ebb tide bar is constructed in conjunction with the creation of the new inlet, ebb tides are likely to temporarily scour the beaches adjacent to the entrance, affecting beach goers and access to these parts of the beach (PWA 2008).

As mentioned earlier, kayakers prefer open water and require a minimum depth of water for paddling. The redistribution of sediments could affect where kayakers are able to paddle – with sediment loss opening up new areas and sediment gain (especially if sediments are added to the Slough to promote salt marsh growth) making other areas impassable. It is important to note here that Alternative 2 includes the opening up of a new channel the length of which could potentially serve as a new thoroughfare for kayakers.

Finally, if changes in sediment budgets affect the depth of channels of navigation, these changes could affect recreational boating. More than likely, however, sediment infilling of channels would be countered by dredging, the cost of which would be borne directly by the harbor.

### *Water Quality and Recreation and Tourism*

Water quality, measured in terms of nutrients, salinity, dissolved oxygen, and contaminants could affect economically important species (Kvitek and Bretz 2004; Ruegg 2007; Wasson 2007) and thus indirectly affect wildlife watching activities. The introduction of human pathogens, primarily from surface water runoff, also could negatively affect uses of the Slough and surrounding habitats that involve direct water contact. The literature also contains many examples of the effect of fecal indicator bacteria and human pathogens on the economic value of beach going in marine and freshwater areas (Bockstael et al.1987; Bockstael et al.1989; Freeman 1995; Hayes et al.1992; Murray et al.2001). Kayaking and recreational fishing within the Slough also could be affected by contamination events.

### *Connectivity of the Slough and Bay and Recreation and Tourism*

Kayakers split their activities between parts of the Slough lying east and west of Highway 1. While it might be possible to portage kayaks and canoes across the highway, clearly the waterway connecting these areas is important for kayakers. A new connection to the Bay, via a proposed channel to a new mouth North of Moss Landing (PWA Alternative 2) could offer new areas for paddling. Aesthetically, however, the new channel would be far different from the waterways of Moss Landing which are home to fishing vessels, pleasure craft, and businesses.

Otters and flatfish and a variety of other species also depend on connectivity between the Slough and Monterey Bay. Restoration alternatives that alter this connectivity could also change the abundance and location of these species. Of economic concern are the potential effects on otters of changes in connectivity between the Slough and Bay. Currently, otter rafts are often seen in the Moss Landing area–the area of highest visitor density. If otters were to move due to changes in connectivity, this could affect the ability of visitors to see otters and subsequently affect the number of visitors to the area.

### *Other Impacts on Recreation and Tourism*

The most immediate impact on outdoor recreation and tourism are likely to come directly from the disrupting effects of construction and loss of access that could be associated with the restoration of the Slough. The Elkhorn Slough and Moss Landing area benefit from easy access off Highway 1. The highway funnels tourists and passersby making their way from Santa Cruz to Monterey directly into the heart of the Moss Landing area. Construction could affect the ease of travel along Highway 1, access to viewing areas, and the ability of visitors (especially kayakers) to access portions of the Slough where restoration activities are underway. Of course, it is possible that some will be drawn to the Slough to watch the restoration activities. Overall, though, it is likely that many current users will reduce their visits to the area during times of construction (table 18).

Alternative 2 would result in significant immediate changes in places where people can participate in recreational activities. New areas for paddling will be created when the new channel is constructed. Recreational anglers may choose to use new jetties for fishing. Alternative 2 also will result in the loss of a substantial amount of beach frontage if a new Slough mouth were to be created. Recently, the CCC found that loss of beach frontage represents a direct loss of recreational value and has charged mitigation fees to offset these losses (CCC 2005 and 1997). At nearby Ocean Harbor House in Monterey, California, the CCC set a mitigation fee of $5.3 million to offset the projected loss of one acre of beach over the course of fifty years (CCC 2005).

**Table 18 Outdoor recreation and relation to Elkhorn Slough habitats**

| Economic Activity | Associated Species | Deep Subtidal | Shallow Subtidal | Intertidal Mudflat | Salt Marsh | Human Access | Sediments | Water Quality |
|---|---|---|---|---|---|---|---|---|
| **Wildlife Viewing** | **Sea otters** | + (use entire Slough subtidal) | + | + | ↔ | | Sediment size important for prey accessibility (clam habitat important) | Affected through prey, bacteria, pathogens, |
| | **Shorebirds** | | | + | ↔ + (secondary foraging for wading shorebirds) | | species vary in terms of needs | Affected through prey |
| **Guide boat tours** | | | | | | + connection between ML and ES | | |
| **Kayaking and Canoeing** | | | | - ( loss of access), + (more otters /shorebirds) | | + connection between ML and ES | | |
| **Recreational Fishing in estuary** | | + | + | + (flatfish species use mudflat invertebrates as food) (most in subtidal) | ↔ | + connection between ML and ES | | Hypoxia, contaminants, and through prey response |
| **Beach Going** | | | | | | Could be impacted by large changes in shoreline and tidal inlet | Could be affected by changes in sediment budgets | - (Local harmful algal blooms) - (Bacteria) -(Eutrophication) |

### 4.1.4 Recreational Boating

Recreational boating in the Slough does not appear to be directly dependent upon Slough conditions, although it is likely that boaters may also enjoy many of the recreational opportunities described above. Approximately 5 percent of those interviewed in the intercept surveys indicated that recreational boating was an important reason for their visit. As with commercial fishing, boaters could be impacted if sedimentation causes an infilling of the channel leading from either North Moss Landing or South Moss Landing to the Monterey Bay, but in all likelihood this is a cost that would be borne by the harbor district through increased dredging. (Of course, this cost could be passed on to recreational boaters and other vessel owners through higher fees and leases.)

### 4.1.5 The Moss Landing Harbor

The Moss Landing Harbor enjoys its unique location immediately contiguous with a rare Pacific estuary and a world-famous deep-water bay. As described earlier, the harbor relies on revenues from businesses that cater to recreation and tourism activity which in turn depends, in part, on access to the Slough and its ecological endowment (see Tourism and Recreation, above). Lease operations in the Harbor generate fees and revenues for the Harbor District that total approximately $400,000 each year, much of which comes from businesses that depend on Slough tourism.

Indirectly, the economic wellbeing of the harbor district also depends on the degree to which conditions in the Slough affect sedimentation of navigation channels within the harbor. Dredging to combat sedimentation can be costly, even for a small harbor. For example, the Corps has spent almost $15 million over the last ten years in dredging expenses for Morro Bay Harbor. The Moss Landing harbor likely benefits from the tidal scouring that has occurred since the harbor entrance was created in 1947. With the exception of sedimentation created by floods in 1995 and 1998 (reflected partly in dredging costs incurred in 1999), the cost of dredging in Moss Landing has remained low over the last eight years (Table 19). Note, more than half of these expenses have been borne by the Federal Emergency Management Agency (FEMA). Additionally, the Corps has dredged the harbor every two to four years since 1947. While Corps dredging expenses have climbed steadily over the period, dredging volumes in the recent years for are substantially less than one half the volume dredged in the 1950s (Figure 29). For the two most recent periods for which data are available (2000 and 2002), dredging costs were under $1 million every two years (Figure 28).

While PWA (2008) is inconclusive regarding the exact effects of Slough restoration on harbor sedimentation, it is likely that sediment budgets will change due to restoration activities that reduce tidal scouring in the Slough. Reductions of tidal scouring will allow more beach sands to fill the Federal Channel (PWA 2008). Furthermore, restoration activities that involve the direct introduction of new sources of sediment to the Slough (e.g. reconnection of the Pajaro or Salinas Rivers to the Slough or the importation of sediment, PWA 2008) and continued connectivity between the Slough and the harbor may have an effect on the sediment budgets for areas within the harbor and thus could affect the frequency and cost of dredging. Dredging expenses represent a direct cost to the Moss Landing economy. Furthermore, shoaling during periods between dredging can increase navigational hazards and result in other direct costs (for instance due to

groundings) and indirect costs to the economy if vessel activity is diminished because of these hazards.

**Table 19 FEMA and Moss Landing Harbor District dredging expenses**

| Fiscal Year | MLH Dredge Expense | Paid by FEMA | Total |
|---|---|---|---|
| 1999-2000 | $4,107,318 | $2,925,684 | $7,033,002 |
| 2000-2001 | $37,505 | $4,148,042 | $4,185,547 |
| 2001-2002 | $8,986 | | $8,986 |
| 2002-2003 | $248,340 | | $248,340 |
| 2003-2004 | $1,773 | | $1,773 |
| 2004-2005 | $10,155 | | $10,155 |
| 2005-2006 | $40,759 | | $40,759 |
| 2006-2007 | $589,814 | | $589,814 |
| **Total** | **$5,044,650** | **$7,073,726** | **$12118376** |

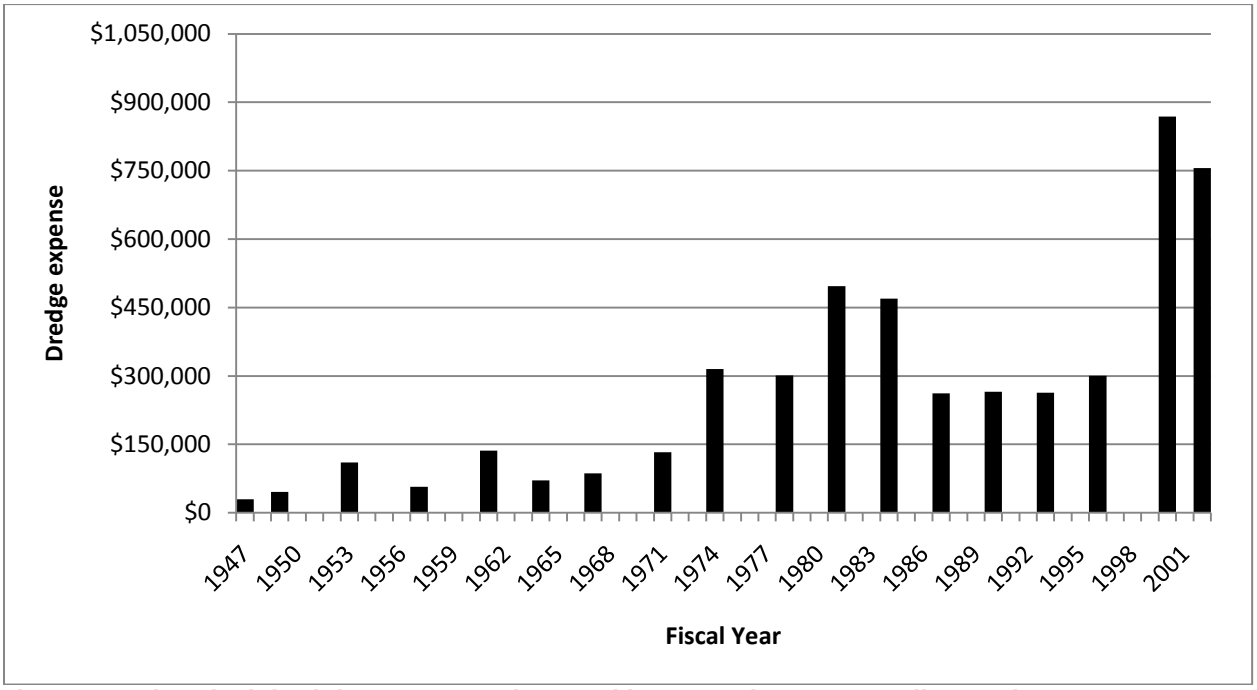



**Figure 28 Historical dredging expenses incurred by Corps in Moss Landing Harbor**

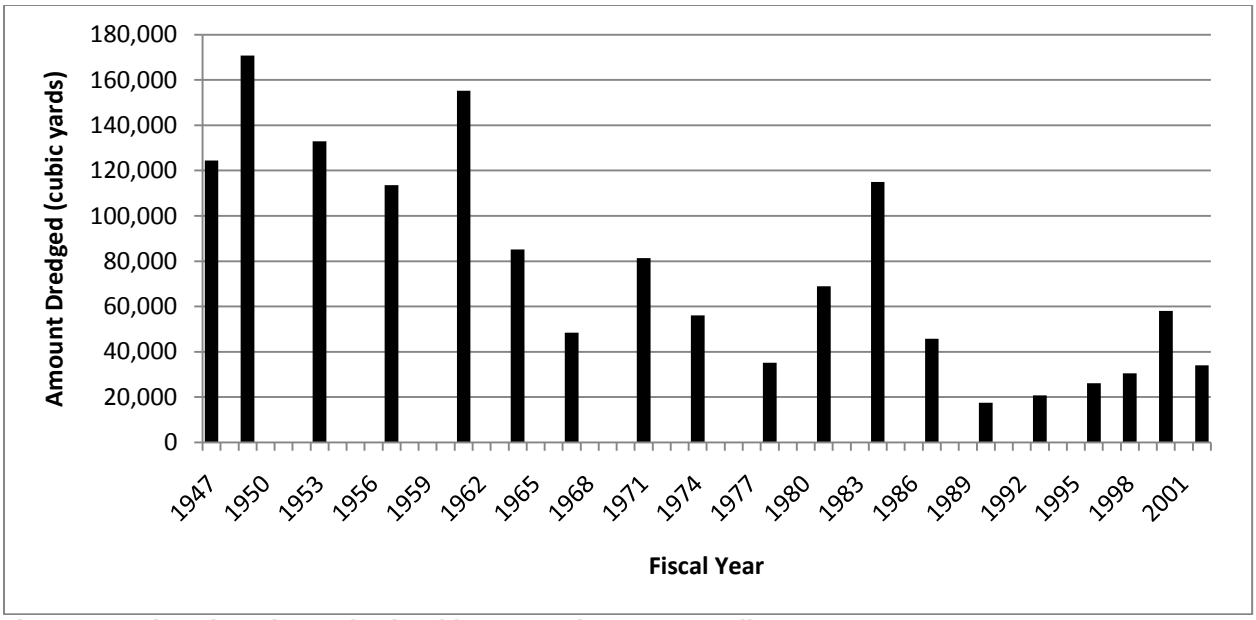



**Figure 29 Historic volume dredged by Corps in Moss Landing**

### 4.1.6 Power Generation

The once-through cooling requirement of the Moss Landing Power Plant demands between 14.5 and nearly 40 cubic meters of water from the Slough each second (LSP Moss Landing LLC 2002-2006 cited in PWA 2008). To function properly, this water must be cool and the system for cooling intake and discharge must remain clean and free from sediments and biological growth.

According to Lee Ganz of the Moss Landing Power Plant, as sediment becomes caked onto the condensers, the efficiency of the condenser is reduced and it must be cleaned. For towers six and seven this is not a large problem as the cleaning would likely be postponed until the towers are next scheduled to be shut down or can actually be cleaned while still partially running. Towers one and two, however, must be completely shut-off in order to undergo condenser cleaning (which run constantly). The power plant is then forced to purchase energy to replace the lost power during maintenance, and must purchase this from an "hourly market" which is much more expensive. During the course of operation, sediment accumulates at the mouth of the intake tunnels and must be removed through dredging activities. In 2001, the dredge spoils contained elevated levels of DDT and required special disposal. The high cost associated with the disposal of these sediments resulted in a cost of roughly $3.5 million for dredging and disposal. Dredging activities (sea disposal) normally would cost only approximately $300,000 for the same amount of materials.

The intimate links between the sediment budgets of the Slough and the harbor area could affect power plant maintenance in a way very similar to that described for harbor dredging generally. A reduction in tidal scouring may result in more inboard deposition of beach sediments near the mouth of the power plant intake tunnels. New sources of sediment to the Slough also could increase dredging costs associated with power plant maintenance.

Biological growth also is an issue that affects the frequency and cost of power plant maintenance. Divers periodically scour the walls of the intake tunnels to remove biological

organisms. (During this time the divers also remove excess sediment that has settled at the bottom of the tunnel.) Failure to perform this maintenance decreases the efficiency of the plant. While Tunnels one and two are in close proximity to one another (a couple hundred feet), Tunnel one has a much higher rate of sedimentation and fouling. There is a screen near the entrance of the tunnels intended to prevent passage of macro-fauna into the tubes. These screens become clogged with biological material and need to be cleaned. Every couple of years the walls are treated with a silicone-based product that prevents the anchoring of sessile organisms on the intake tunnel walls. This was most recently completed in 2002, but one tunnel will need to be redone soon due to insufficient application. Blue-green algae has also recently become an issue (Lee Ganz, personal communication).

# 5 Policy Methodology and Approach

To avoid "second guessing" potential Elkhorn Slough restoration scenarios, information about the experiences of others with similar estuarine restoration activities has been compiled, using a case study methodology with the following steps:

1) Identify important attributes of Elkhorn Slough that should be present in other cases.
2) Detail the political and jurisdictional structure that influences what happens at the Slough to ensure a similar policy environment is present in comparable cases.
3) Analyze all potential restoration cases to determine the three that meet the criteria for comparison.
4) Devise a survey to solicit relevant information and use both written and oral channels to obtain clear information.
5) Analyze the compiled data and summarize "lessons learned" as they might apply to relevant scenarios for the Slough.

After identifying dozens of estuarine restoration cases throughout the United States, the team determined that the governing structures for the coastal zone were unique to the West Coast and focused on only those cases from Washington, Oregon and California as potential candidates. Further, it determined that California's coastal management governing structure through the CCC was also unique and precluded using other states as examples to inform the Elkhorn Slough process. Therefore, the search was narrowed to California estuarine restorations only. This document reports findings based on analysis of evidence gathered from the three cases selected: the Bolsa Chica Lowlands Restoration Project, San Pablo Bay restoration of the Napa-Sonoma Marsh, and the Morro Bay Estuary Habitat *Restoration Project*. The purpose of this analysis is to provide guidance for recommending a range of restoration options under consideration for the Elkhorn Slough.

The Policy Team focused on implementation activities throughout the three case studies extrapolating appropriate and comparable information for restoration option analysis. Others from the Elkhorn Slough and related agencies and organizations, focused on the planning and post-implementation phases.

The variables used to select the case studies included the key attributes of Elkhorn Slough. In each case study engineering, scientific, and economic variables, as well as, political and legal attributes were reviewed that could inform the decision-making process, and influence the success of the proposed restoration options for Elkhorn Slough. (For the purpose of this report the case studies have been summarized; the complete studies are found in the appendix).

All the potential case studies were required to meet all preselected criteria (see table 20) regarding scale, geography, and political parameters. Economic activities required three of the four criteria for consideration. Restoration activities at Bolsa Chica Lowlands, San Pablo Bay's Napa-Sonoma Marsh, and Morro Bay Estuary were found to satisfy all requirements.

After the selections, a survey was drafted to obtain information from site managers about their experiences with permitting, economic activities and the policy process. The survey also incorporated questions pertaining to restoration activities undergone or attempted, and the

lessons learned. The survey was mailed electronically to the project managers with a letter explaining the purpose of the survey. The surveys were used as the basis for the case study analyses.

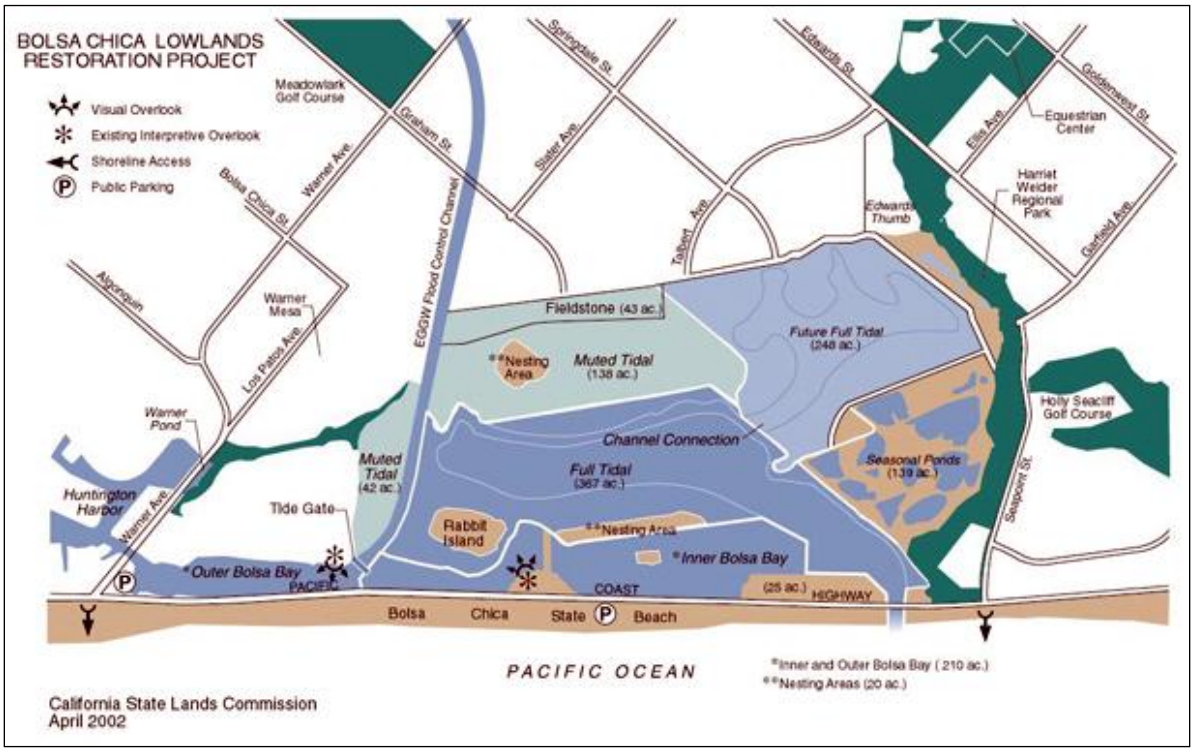
**Table 20 Research criteria for selecting comparative cases**

| VARIABLE | ATTRIBUTE | |
|---|---|---|
| **Scale** | 400-10,000 acres | |
| **Geography** | California | |
| | West Coast | |
| **Population Served** | Number | |
| | Nature | Rural |
| | | Urban |
| **Restoration Activities** | Large Amount of Sediment Added | |
| | Change Tidal Prism | |
| | High Pollution Levels Addressed | |
| | Movement of Major Roadways | |
| | Cost of Restoration | |
| **Jurisdictions** | Types | Federal |
| | | State |
| | | Local |
| | | Private |
| | Number per Restoration Site | |
| **Similarity of Economic Activities** | Power Plants | |
| | Tourism | Kayaking |
| | | Beaches |
| | | Wildlife Viewing |
| | | Bird Watching |
| | Harbor | Commercial Fishing |
| | | Recreational Fishing |
| | Agriculture | |

## 5.1 Bolsa Chica Lowlands Restoration Project

California's Bolsa Chica wetlands, located in Orange County, met the preselected criteria for a comparable case-study, given the emphasis on the role of EBM for tidal wetland restoration in the area.

Physical restoration began on 600 acres of tidal wetland in 2004 and reached completion in 2006 (figure 30). Bolsa Chica falls within the guidelines of 400 to 10,000 acres approved by the EBM Team. Additionally, the Elkhorn Slough confronts similar problems with nutrient loading, marsh loss, and habitat erosion warranting similar restoration activities conducted during the Bolsa Chica project.




*Source: California State Lands*

**Figure 30 Bolsa Chica habitat area diagram**

The restoration underwent specific activities to reestablish tidal flow from the ocean, and increase salt marsh habitat. To achieve the biological benefits of tidal restoration, a direct connection to the Pacific Ocean was reestablished through the creation of a new tidal inlet that cut through Bolsa Chica State Beach and under the Pacific Coast Highway near the Huntington Mesa (Bolsa Chica). Restoring the ocean connection required the construction of two new bridges, one for the Pacific Coast Highway and one to provide continued access to the existing oil field operations on the site. A total of approximately 2.7 million cubic yards of dredge material was removed and then reused after sediment cleaning. Seven hundred fifty thousand (750,000) cubic yards of the clean dredged sand created an ebb shoal off the shore of the inlet, and approximately one million cubic yards were used to build the tidal basin containment berms and nesting areas (Fancher 2007).

### *Permitting and Permissions*

Following the case study criteria, approval for the Bolsa Chica project included federal, state and local agencies, as well as private organizations. The primary permits necessary for the addition of sediment included the Corps Clean Water Act 404 permit for discharge of dredge or fill material in waters or wetlands of the United States, and the Coastal Zone Management Act Federal Consistency Determination (Army). A Regional Water Quality Control Board storm-water permit was needed to dewater the construction site so that contaminants and non-sand sediment could be removed using heavy equipment. No local grading permits were necessary (Fancher 2007).

The same permits necessary for sediment addition were also needed for tidal restoration (Fancher 2007). However, encroachment permits were required from the Caltrans and California Department of Parks and Recreation to build the Pacific Coast Highway bridge (Caltrans, CDPR). The U.S. Coast Guard also issued a Rivers and Harbors Section 9 Bridge Permit (U.S. Coast Guard).

Three different written agreements were required, reviewed, and approved before the encroachment permit was issued (Fancher 2007). The Pacific Coast Highway separated the Bolsa Chica wetlands from the ocean beach. To restore the wetland with a full tidal range, it was necessary first to reestablish the ocean connection. This was accomplished by excavating a new inlet through the Pacific Coast Highway and to the beach (Bolsa Chica). A new bridge had to be constructed to maintain the Pacific Coast Highway traffic flow. In order to maintain traffic flow even during construction of the new bridge within the existing right-of-way, a detour had to be constructed. The detour did not interfere with the oil company access to existing State lease oil wells. Also, the drip line of the new bridge and abutment shoulders would extend slightly onto State Beach property. Caltrans required an encroachment permit for the project to accomplish the detour and the bridge construction.[9]

### *Obtaining Necessary Permits and Permissions*

The level of difficulty in obtaining permits and permissions depends on the length of time required to obtain the documents or reach agreements, including associated obstacles that may occur prior to approval. The Coastal Program Coordinator for California Fish & Wildlife Service, Jack Fancher, who oversaw the restoration activities at Bolsa Chica, ranked the permitting process, 10 being the most difficult to acquire (table 21) (Fancher 2007).

The Bolsa Chica Lowlands Restoration Project spanned ten years from the implementation of the interagency agreement (1997) to opening the new ocean inlet (2006). The permitting process was ongoing through 2002; however, not all permissions were sought at the same time or in a specific sequence. The EIR/EIS preparation extended nearly four-years from scoping in late 1997 to the final EIR/EIS in 2001. The two major permitting actions, the Corps Clean Water Act section 404 permit and CCC Federal Consistency Determination, consumed approximately nine months. The Corps took approximately four months to produce a public notice followed by nearly eight

[9] Many of these steps are similar to those necessary for the most ambitious of the restoration options proposed for the Slough e.g. creation of a new outlet for the Slough into the Bay, a new mouth for the Salinas River, construction of a bridge on a piece of Highway 1.

months to issue the permit in 2002 and the CCC Federal Consistency Determination took a total of six months, with adoption of findings in early 2002. Both required separate and additional public review steps, despite the absence of significant opposition or controversy. Each preferred the other to have completed its process before completing its own. Ultimately, in spite of the disconnected parallel nature of their considerations, the mitigation measures and project description were the same in both of the permitting processes, consistent with the EIR/EIS mitigation measures and project description (Fancher 2007).

**Table 21 Permits acquired and corresponding difficulty: Bolsa Chica Restoration Project**

| Permit | Attainability Rank |
|---|---|
| Reimbursable Agreements and Construction Lease | 1 |
| U.S. Coast Guard Bridge Permit | 1 |
| Rivers and Harbors Section 10 Permit | 1 |
| Federal Endangered Species Act: section 7 and 10 Permit (ESA) | 1 |
| Water Quality Certification (CWA) | 3 |
| Waste Discharge Permit | 3 |
| Private Property Encroachment Permit | 5 |
| Interagency Agreement | 5 |
| Flood Control Encroachment Permit (Department of Water Resources) | 6 |
| Section 404 Individual Permit | 6 |
| CDFG CESA 2081 Permit (CESA) | 7 |
| Voluntary Cleanup Agreement | 7 |
| CCC Federal Consistency Determination | 7 |
| City of Huntington Beach Traffic Plan Approval | 8 |
| California Department of Parks and Recreation Encroachment Permit | 8 |
| California Department of Transportation Encroachment Permit | 10 |

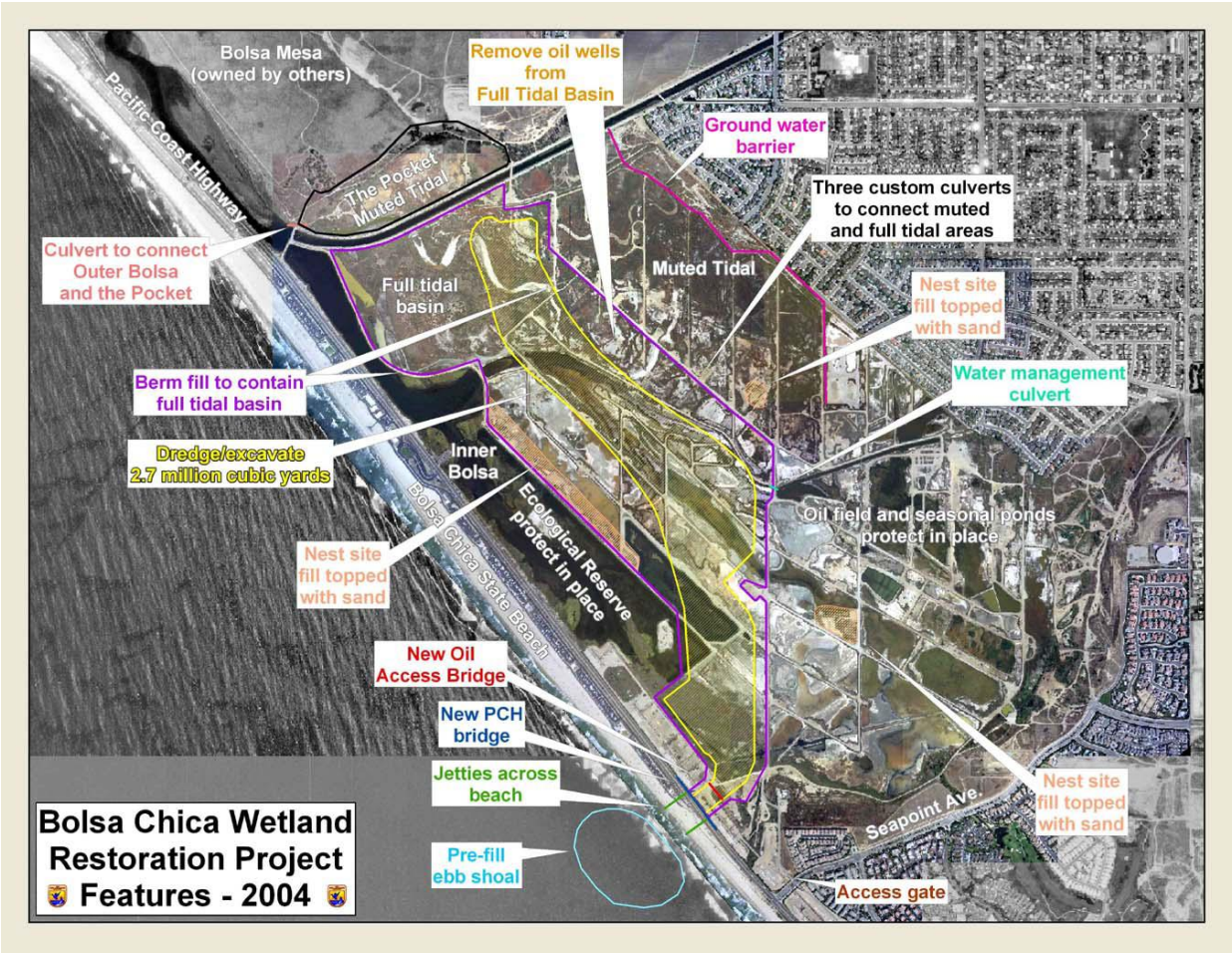
Several of the minor permissions had longer approval periods and contributed to project delays. Permitting entities trying to obtain unrelated benefits compounded time and money lost during the process. Intentionally slowing their processing to gain leverage became a burden to project managers that wanted to begin restoration. Caltrans, State Parks, Orange County Flood Control, and City of Huntington Beach contributed to slowing the project. For example, Caltrans tried to persuade the restoration project managers to widen Pacific Coast Highway from four to six lanes for two miles next to Bolsa Chica to prevent reduced access (Fancher 2007).

### *Costs of Restoration*

The area surrounding Bolsa Chica wetlands includes economic activities such as tourism, ecotourism, oil field operations, outdoor education, and birding, much the same as the Slough, but under a more urban environment (figure 31). Any negative economic impacts from the restoration project stemmed from temporary construction activities, and were insignificant or very minor according to those interviewed. Pre-construction, the regional multipurpose trail along the beach had to be temporarily rerouted around the construction zone. The oil company filed "lost revenue" claims due to the Pacific Coast Highway detour blocking its oil well maintenance access. The CCC completed an agreement to reimburse "lost revenue" to the oil company for blocked access to dysfunctional oil wells (Fancher 2007).

One small beach and the public access trails were closed for safety purposes, reducing the number of visitors during the construction period. Ecotourism, birding tours, and outdoor education class trips along the trail had to stop at Bolsa Chica during that time. Construction of

the inlet and ebb shoal constrained some beach areas where activities such as safe surfing, surf fishing, body surfing, and sunbathing normally occurred; however, many beaches remained unaffected. The normal heavy traffic load on Pacific Coast Highway was unimpeded, and a notorious flooding zone of the highway was eliminated by the new bridge. Some of the cycling community objected when told they should avoid the construction detour for safety reasons (Fancher 2007).




*Source: U.S. Fish and Wildlife Service*

**Figure 31 Bolsa Chica Wetland Restoration Project features**

During the construction period, information on the project's history, construction schedule, and public access curtailments was made available to the public by full color leaflets[10] and a website. After construction, recreational fishing at the new inlet became very popular. The fish nursery function of the restored tidal wetland indirectly benefits recreational fishing, particularly for those targeting California halibut. The ebb shoal construction is reported to beneficially impact the surfing conditions. The new trails and overlooks are very popular with visitors. Re-routing the multi-use trail up onto the Pacific Coast Highway bridge, yet safe from the traffic lanes, is also popular (Fancher 2007).

[10] Leaflet is available at http://www.fws.gov/bolsachica/projectdescription/BCinfoleaflet.pdf.

### *Lessons Learned*

The project lead with the FWS, provided helpful insight and lessons learned based on the restoration expectations and goals from the Bolsa Chica restoration. The environmental review required a multi-agency collaboration causing the process to progress more slowly, which may have been more efficient under a single agency lead. Another significant delay resulted from the decision to complete specific engineering analyses responding to concerns raised during the commenting period of the draft EIR/EIS. Although project activities experienced some delay, the highly detailed information presented in the documentation ensured that no legal challenges occurred under NEPA/CEQA. If environmental impacts are not accurately predicted and thoroughly documented, the restoration project faces further obstacles and potential rejection. *The lesson learned is that investing in adequate engineering analyses will reduce the likelihood of legal challenges to the project* (Fancher 2007).

Certain agencies caused delays in acquiring permits and permissions necessary to allow some restoration actions to occur on schedule. Delays resulted from the failure to produce the public notice in a timely fashion, and other postponements occurred because agencies lagged in providing particular permits. Some of these delays can be avoided by conducting the permit applications early in the process. For instance, the Corps section 404 permit was sought early, and the twelve-month delay did *not* postpone commencement of the restoration. *The lesson learned is that seeking permits early allows certain project activities to move forward, while the approval process for other activities continues – avoiding unnecessary project delays.*

In order to address high levels of pollutants, the FWS chaired an interagency technical committee that characterized the extent of the contamination at the project site. This committee produced an Ecological Risk Assessment providing several recommendations for cleanup goals. The cleanup was completed in the muted tidal areas (wetlands with limited tidal exchange), and continues in the Future Full Tidal and Seasonal Pond areas. This interagency committee allowed for regulatory agencies to stay updated and involved in the planning and design process. *This lesson learned is that incorporating multiple agencies into various facets of the project is essential for building interagency partnerships and collaboration.* (Fancher 2007).

Other lessons learned include:

- Project managers should develop a consensus work plan or agency cooperation agreement for "core" participants, designed to establish collective objectives and to reduce effects of staff turnover. This type of collaborative agreement also reduces the introduction of doubtful or unprofessional judgments, and hidden agendas, which may be common in large diverse groups.
- Prior to the preliminary planning phase, developing collaboration between the coastal engineers and the biologists is instrumental for designing the objectives and mechanisms or methods to achieving the project goals.
- Provide regulatory agencies every opportunity to participate and stay informed in project planning and design, although estuarine managers need to move forward if agencies do not contribute.
- Avoid funding issues by requesting written commitments or letters of intent of promised funds before proceeding with construction contracts.

- Make contact information available by telephone numbers and e-mail and website addresses in public areas associated with the project for additional commenting. In addition, provide quick responses to comments.
- Ensure that interagency partnerships establish an authoritative title that indicates strong support for wetland restoration. This emphasizes the importance that committees provide for expediting complex and expensive restoration projects, guiding both public and agency perceptions.

## 5.2 Napa-Sonoma Marsh Restoration Project

California's San Pablo Bay watershed drains into the northern reaches of San Francisco Bay, and is a major drainage basin for Marin, Sonoma, Napa, Solano and Contra Costa Counties. An estimated 85 percent of the historic tidal marshes in the San Francisco Bay-Delta Estuary have been filled, or significantly altered, over the past two centuries (figure 32). The San Pablo Bay's diked baylands necessitated large-scale restoration of tidal marsh, and state and federal resource and regulatory agencies have purchased a number of properties within the Napa-Sonoma Marsh Complex for restoration (Napa-Sonoma Marsh Restoration Project 2001).

The California State Conservancy, CDFG, and Corps undertook a Feasibility Study to evaluate alternatives for the reduction of salinity and restoration or enhancement of habitats in the Napa River Unit. Some of the inactive salt ponds currently provide significant habitat for fish and wildlife, while the salinity levels in others exceed that which is beneficial to wildlife. The project objectives for the Napa River Unit were: (1) to restore large patches of tidal habitats in a band along the Napa River, in a phased approach, to support a wide variety of fish, wildlife and plants, including special status species; and (2) to effectively manage water depths and salinity levels of remaining ponds to benefit migratory and resident shorebirds and waterfowl (Hitchcock & Hutzel).


*Source: Miles, A. K. et al.*

**Figure 32 Napa-Sonoma Marsh complex**

Other major reasons for undertaking this project include:

- Extensive habitat for endangered species, migratory waterfowl and shorebirds, and fish and other aquatic species.
- A beneficial use for recycled water.
- Improved water quality and productivity in the Napa River and San Francisco Bay.
- Public open space and recreational opportunities, including fishing, bird watching, hunting, and environmental education.

In order to achieve a tidal prism, 25 internal and external levee breaches, 15 ditch blocks, and several miles of channel excavation and levee lowering occurred in three salt ponds, totaling 2,900 acres. High levels of pollutants were detected in the ponds. Hydrodynamic modeling was

conducted to analyze the impacts of breaching the salt pond levees. This issue was of most concern to the San Francisco Bay Regional Water Quality Control Board, and was addressed with the timing of the initial breaches during rainy season and the maximum salinity level allowed (Hutzel 2007).

### *Permitting and Permissions*

Following the case study criteria, approval for the Napa-Sonoma Marsh Restoration Project included federal, state, and local agencies, as well as private organizations. Various permits were required to complete the restoration of the Napa-Sonoma Marsh due to the movement of 500,000 cubic yards of material around the project site. Associated activities requiring permitting included: the internal and external levee breaches, ditch blocks, channel excavation, and levee lowering. These permits eventually gained approval from the Regional Water Quality Control Board, San Francisco Bay Conservation and Development Commission (BCDC), Corps, NMFS, and the CDFG.

The majority of permits related to coastal and aquatic construction actions. Extracting sediment requires a Corps Clean Water Act section 404 permit. Additionally the Corps requires a Rivers and Harbors Act Section 10 permit for developing a structure over any designated navigable waters.[11] Other federal permits needed for this restoration project were mandated by the Endangered Species Act (both sec. 7 & 10), which require consultation and confirmation for incidental takes[12] on endangered or threatened species. The BCDC regulates activities along the shoreline of San Francisco Bay requiring permits for any projects in that region, therefore is not applicable to Elkhorn Slough.

### *Obtaining Necessary Permits and Permissions*

The ease or difficulty in obtaining permits and permissions is based on the length of time required to obtain the document, as well as any associated obstacles that may have occurred prior to permit or permission approval. The Project Manager, Amy Hutzel, oversaw the restoration activities and ranked permit acquisition with 10 being the most difficult (table 22).

**Table 22 Permits acquired and corresponding difficulty: Napa-Sonoma Marsh Restoration**

| Permit | Attainability Rank |
|---|---|
| Rivers and Harbors Section 10 Permit | 2 |
| Clean Water Act Section 404 Permit | 3 |
| Section 401 Certified Nation Wide Permit | 4 |
| Federal Endangered Species Act: Section 7 and 10 Permit | 6 |
| Water Quality Certification (CWA) | 7 |
| Waste Discharge Permit | 7 |
| San Francisco Bay Conservation and Development Commission Permit | 7 |

In this case study, permitting did not create any significant obstacles to the physical activities or timeliness of project operations. The major impediment to the restoration process derived from

[11] U.S. "navigable waters" are those subject to the ebb and flow of the tide shoreward to the mean high water mark and/or presently used, or have been used in the past, or are susceptible for use to transport interstate or foreign commerce.

[12] "Take" occurs when there is harm, harassment, or mortality to an individual endangered or threatened species or to their critical habitat.

the Corps's failure to hastily produce an environmental impact analysis and the inability to approve legislation authorizing the federal funds portion for the restoration project.

One year after completion of the environmental impact analyses, the appropriate permits were obtained allowing restoration efforts to commence. The EIR/EIS was tied to the Corps Feasibility Report, which was the major step that affected the schedule and slowed the release of the CEQA/NEPA documents.[13] Ultimately, the documents were split and the final EIR was released in advance while waiting for the Corps to approve the release of their Final Feasibility Report and attached final EIS (Hutzel 2007). The Napa-Sonoma Marsh Restoration Project moved on entirely without the Corps. In order for the Corps to participate, Congress needed to ratify the Water Resources Development Act 2007. At the time of this report, the restoration activities were contracted to a private company to complete a 50 percent design for a portion of the project. Further development needed to advance to the 90 percent level and to concurrently prepare the necessary permit applications I ongoing, with a slow trickle of funds coming in from local, state and federal sources.[14]

### *Costs of Restoration*

Its total cost estimate for the lands, final design, construction of all the ponds and the pipeline, construction management, monitoring, and adaptive management was $135 million. Actual costs were reported as follows at the latest meeting of the Sonoma County Board: funding is available from the $2 million appropriation in the Water Conservation Fund. Of the $110,000 amendment, the Bureau of Reclamation funds $55,000 and of the remaining $55,000, other member Agencies (Napa Sanitation District, Novato Sanitary District, and Las Gallinas Sanitary District) share is $36,954; the Sonoma County Water Agency share is $6,685; and the Sonoma Valley County Sanitation District share is $11,361. It is anticipated that the Corps will conduct all of the additional work and the State will be credited for the construction work completed to date. Corps restoration projects are cost shared 35 percent non-federal and 65 percent federal.

The restoration is predicted to enhance the surrounding economy due to preservation of the high visual quality that contributes to the living environment of local residents and the county's tourism. The Napa-Sonoma area is characterized by a mostly rural atmosphere, which allows for economic activities such as fishing and tourism. Restoration activities were reported to improve fishing and hunting activity. Most restoration activities are in their initial stages or have only recently been completed. Therefore future cost and benefit data will be available at a later period. To date, the cost of construction has totaled about $15 million for tidal restoration of three ponds along the Napa River totaling 3,000 acres and enhancement, via new water control structures and levee improvements, of three ponds totaling 1,700 acres, plus some public access improvements.

### *Lessons Learned*

The Napa-Sonoma Marsh Restoration Project reveals clear impediments to project planning and implementation. These lessons can be extrapolated in order to avoid similar obstacles during the potential restoration activities at Elkhorn Slough. The main problems confronted during the

[13] Under CEQA and NEPA, the CDFG and the Corps were the lead agencies, respectively.
14

project involve vertical coordination at different levels of government, public outreach, and undefined performance criteria (PWA 2005). In addition, the project lead with the California Coastal Conservancy provides helpful insight and lessons learned based on the restoration expectations and project goals.

In this case study, project managers felt that stakeholder meeting turnout could have been stronger. The Napa-Sonoma Marshes are fairly isolated and remote, reducing the number of people, organizations, and agencies interested in details of the project. In the South San Francisco Bay region, larger stakeholder outreach efforts were attempted, due to a greater number of interested parties and the adjacency of the project to homes, businesses, and infrastructure (Hutzel 2007). The Napa-Sonoma Marsh Restoration Group held meetings every three to six months inviting outside regulatory agencies, non-governmental organizations, and science groups. Public meetings for response to the environmental impact analyses were held on three occasions over the course of the project. *The lesson learned regarding stakeholder communication implies that future meetings should focus on reaching out to a larger audience*.

Especially relevant to the Elkhorn Slough restoration is determining the course of action based on the desired outcomes. The Elkhorn Slough team faces much the same decision to change environmental conditions favoring either a more marine or salt marsh habitat, which ultimately will result in impacts on endangered species such as the Southern California sea otter, just as the Napa-Sonoma project faced debates over whether the restoration outcomes should support a pristine salt marsh ecosystem or conditions more favorable to endangered species. This conflict created a major obstacle in terms of planning and environmental compliance because while reports and assessments were being developed, managers were undecided on the overall objectives. *The lesson learned is to design actions to favor a particular outcome, which makes declaring success less difficult*.

Decision-making sometimes requires complex internal consensus-building, among various stakeholders and among different agencies at all levels of government. Regulators, landowners, and other groups exhibited significant differences of opinion regarding project direction. Specifically, disagreements arose when determining the amount of public access as well as concerns and unknowns about the pollution associated with marsh restoration. The latter concern is similar to that faced by Elkhorn Slough with its unprecedented heavy nutrient load and the prospect of increasing the problem by returning parts of the Slough to salt marsh. These mismatches between expectations and outcomes in this case study created a severe schedule lag-time at all stages (planning, implementation, monitoring, and evaluation). *The main lesson learned for future restoration projects is that original expectations must be tracked forward and discussed in context of actual outcomes, incorporating best professional judgments combined with all monitoring data to explain whether expectations are being met or not*. The results provide new insight for and iterative process of future design and performance criteria.

The complicated nature of coordination between Napa-Sonoma Restoration Project managers and the Corps warrants an individual analysis in terms of what lessons can be learned. Bureaucratic procedures and formalities led to major funding uncertainties, lost time resulting from required analyses (incremental cost analyses, real estate, etc.), and time consumed in the review process by Corps divisions, headquarters, and Assistant Secretary of the Army's office.

The Coastal Conservancy and the CDFG might have chosen to do the project without the Corps. Federal involvement should pay off in terms of dollars provided, but slows the project planning considerably and adds costs to the planning effort. *The lesson learned is that partnerships and Feasibility Studies should be conducted with the Corps only when the cost of the project is too great for the non-federal agency to bear*. Certain activities would not have been completed without the cost share. Therefore due to the large-scale and high costs for this particular restoration project, the efforts were worthwhile to partner with the Corps, even incorporating added time constraints and bureaucracy.

Other Lessons Learned:

- Project managers should establish more specific and interim targets, while also defining thresholds that indicate a point to take other actions. These targets would supplement preliminary and 20-year goals, serving to guide the in-between period.

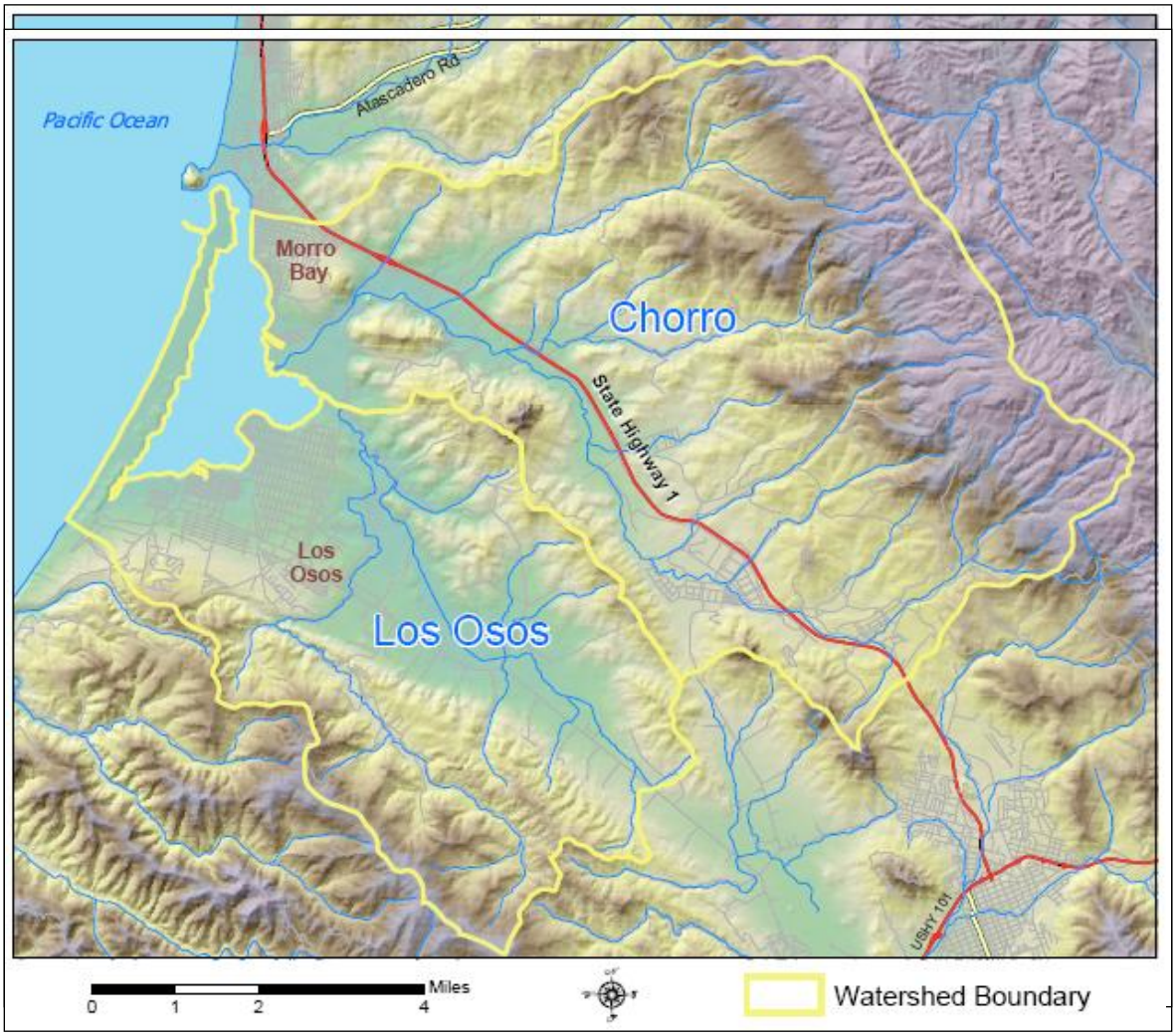
- Provide diversity of success criteria to achieve multiple ecological and economic goals and also as indicators to how restoration activities impact local conditions. Examples of success criterion include: percent plant cover, species diversity, and tourism and recreation revenues.

- Ensure that performance targets are not only based on scientific principles, but also adequately reflect public expectations. Ideally, these should be the same if the public has been informed on a timely and effective basis.

- Perform management actions in a systematic, explicitly hypothesis-testing manner to improve reliability of assessing the project's overall status. For instance, projects should develop a conceptual model that includes defined objectives and hypothesized outcomes. Then create management and monitoring activities that provide thorough evaluation.

## 5.3 Morro Bay Restoration

Morro Bay is a small estuary and harbor of 2,300 acres that flows into the Pacific Ocean near the easternmost extent of Estero Bay. The naturally shallow lagoon is located in San Luis Obispo County on the central coast of California approximately 100 miles south of Monterey Bay and 60 miles north of Point Conception (figure 33).




*Source: Morro Bay National Estuary Program*

**Figure 33 Morro Bay watersheds and estuary**

Morro Bay is approximately four miles long (in a north-south direction) and less than two miles wide (east-west direction) at its widest point. Morro Bay receives freshwater input from the perennial Los Osos and Chorro Creeks, as well as from groundwater seeps. Much of the bay is very shallow and the entire bay is influenced by tidal flushing. The mouth of the bay is both engineered and dredged. Restoration activities failed to commence due to an unanticipated increase in cost estimates, the extended periods of time consumed in the assessment process, and technical problems. Budgetary overruns with coordinating agencies stunted the process due to the growing costs for the non-federal portion of the cost-share. Another financing problem arose because of the federal budgeting process, whereby funding required annual approval and was not

guaranteed. Time length for analysis documents expanded due to the large number of iterations required to finalize drafts and exorbitant amounts of time spent assessing the No Action alternative. Finally, technical issues regarding the expensive costs to dispose of the dredged fine grain sediment posed a significant barrier.

The original decision to restore Morro Bay resulted from the highly degraded condition of this stream reach and potential for connectivity with recent and planned restoration both upstream and downstream. Specific issues confronting the estuary included sedimentation, bacterial pollution, high nutrient loads, reduced freshwater flow, toxin presence, and habitat loss.

Consideration of two restoration alternative categories emerged from the feasibility study with each weighed against the No Action alternative. The first set of alternative measures included restoration activities conducted within the bay, some of the actions included: dredging wind driven sand and other sediment, establishing sand control structures, constructing culverts, etc. The second set of alternatives addressed measures within the watershed: salt marsh restoration, developing sediment capture schemes, and applying best management practices to restore native vegetation. Individual implementation and combinations of the restoration alternatives were incorporated with the open-ended possibility that other alternatives could be identified as the process developed.

### *Permitting and Permissions*

Following the case study criteria, approval for the Morro Bay project included federal, state, and local agencies. Although the project did not reach completion, certain permits were obtained during planning. The primary permits necessary for the addition of sediment included the Corps Clean Water Act 404 permit for discharge of dredge or fill material in waters or wetlands of the United States. The CDFG required an agreement for any streambed alteration that may impact an existing fish or wildlife resource. Finally, a county permit was obtained along with an approved storm water plan. Other permits would have been required had the restoration activities proceeded.

### *Obtaining Necessary Permits and Permissions*

The ease or difficulty in obtaining permits and permissions is based on the length of time required to obtain the document, as well as any associated obstacles that may occur prior to permit or permission approval. This included costs to pay independent contractors to develop plans in compliance with the permit. The Project Manager, Dan Berman, oversaw the restoration activities and ranked permit acquisition with 10 being the most difficult (table 23).

**Table 23 Permits acquired and corresponding difficulty: Morro Bay**

| Permit | Attainability Rank |
|---|---|
| Section 401 Certified Nation Wide Permit | 2 |
| Stormwater Plan | 3 |
| CDFG Lake and Streambed Alteration Program | 3 |
| County Permit | 4 |
| Clean Water Act Section 404 Permit | 8 |

Agencies designed a unique system for expediting the permitting process at Morro Bay. An agreement between the Corps, the Coastal San Luis Resource Conservation District and the

Natural Resources Conservation Service (NCRS) sought to join efforts to preserve, protect, and restore aquatic resources in the sensitive Morro Bay watershed in central California. The Los Angeles District agreed to provide 30-day processing of nationwide permit applications for projects that qualify under the "Morro Bay Partners in Restoration Program" (PIR). The objective was to provide "one-stop regulatory shopping". PIR programs helped reduce the complexities associated with regulatory review, thereby removing disincentives for farmers, ranchers and rural landowners otherwise discouraged by the time, cost and complexity of rules governing their management practices. The Morro Bay PIR program consists of a series of regulatory agreements and permits issued to the NCRS and Coastal San Luis Resource Conservation District that cover a specific set of activities/best management practices within a strictly defined geographic area, in this case, the Morro Bay watershed.

### *Lessons Learned*

The Morro Bay restoration project provides important insights into the complexities and challenges surrounding a large-scale restoration initiative. The Elkhorn Slough faces decisions on varying degrees of restoration alternatives ranging from sediment fill to sill installation to complete watershed rerouting. This case-study serves as a guide for planners to help make the final determination. As described above the restoration activities halted due to increased cost estimates by the Corps over their original estimates, time limitations, and technical problems. The Program Director with the National Estuary Program at Morro Bay provided helpful insight and lessons learned based on the restoration expectations and project goals.

The majority of difficulties arose from coordination efforts between the lead agency and the Corps. A number of challenges ensued regarding product quality, scheduling, and budgeting. The federal funding process presents uncertainties, which may not ensure annual appropriations to the project and potentially hinder success. *Although certain projects may necessitate Corps assistance, it is advised that assessment work is handled internally by hiring consultants to determine the course of action. Then if further assistance is needed, request support from the Corps*.

Certain expenditures exceeded the budget due to accommodating stakeholder input received late in the restoration process. Accepting many suggestions led to expensive re-designing of project elements. Stakeholder input is critical prior to the final design work and should be considered for inclusion in the plans. Although there is a point when it becomes difficult and expensive to make even minor changes and this notion needs to be clear to participants and managed accordingly. *The lesson learned is that issues raised by stakeholders must be carefully evaluated so that the benefits of any design changes outweigh the costs and efforts and don't ultimately sink the project because of unjustifiable high costs*

## 5.4 Summary of Lessons Learned from Three Case Studies

Broad based findings from three California estuarine restoration case studies helped identify policy issues that affected other restoration projects. They resulted in lessons learned that can help Elkhorn Slough managers to negotiate the political process more effectively. Below is a summary list of the key findings from the case studies. Each lesson learned derived from a specific estuary restoration case study, is abbreviated in parentheses.

Bolsa Chica Lowlands (BC)
Morro Bay (MB)
Napa-Sonoma Marsh (NS)

### *Agency Participation/Information Sharing*

1. Provide regulatory agencies every opportunity to participate and stay informed of project planning and design. (BC)
2. Establish interagency partnerships that provide wetland restoration support and give them a clear organizational role This emphasizes the importance that collaboration provides for expediting complex and expensive restoration projects, guiding both public and agency perceptions. (BC)
3. Avoid funding issues by obtaining written commitments or letters of intent for promised funds before proceeding with construction contracts. (BC)
4. Develop a consensus work plan or agency cooperation agreement for "core" participants, designed to establish collective objectives with a written record for continuity and to reduce effects of staff turnover. This type of collaborative agreement also reduces the introduction of doubtful or unprofessional judgments, and hidden agendas, which may be common in large diverse groups. (BC)
5. Handle assessment work internally with private consultants to help determine the possible course of action. If further assistance is needed, request support from the Corps. (MB)
6. Conduct Feasibility Studies and form partnerships with the Corps only when the cost of the project is too great for a non-federal group or other government agency to bear. (NS)

### *Expert Collaboration*

7. Develop collaboration between the coastal engineers and scientists for designing objectives and mechanisms for achieving the project goals. This should be conducted prior to the preliminary planning phase, ensuring that environmental considerations are fully covered. (BC)

### *Stakeholder Outreach*

8. Focus meetings on reaching out to broader audiences. (NS)
9. Evaluate issues raised by stakeholders so that benefits of any design changes outweigh costs and efforts.

### *Project Monitoring and Evaluation*

10. Design actions to favor a particular outcome, which makes declaring success less difficult. (NS)
11. Track original expectations forward and discuss them in the context of actual outcomes, incorporating best professional judgments combined with all monitoring data to explain whether expectations are being met or not. (NS)
12. Establish specific and interim targets, while also defining thresholds that indicate a point when to take other actions. These targets should supplement preliminary and 20-year goals, serving to guide the in-between period. (NS)

13. Use a diverse set of criteria to achieve multiple ecological and economic goals and also as indicators to how restoration activities impact local conditions. Examples of success criteria include: percent plant cover, species diversity, and tourism and recreation revenues. (NS)
14. Ensure that performance targets are not only based on scientific principles but also adequately reflect public expectations and political realities.* (NS)

### *Science-based Project Implementation*

15. Perform management actions in a systematic, explicitly hypothesis-based manner to improve reliability of assessing the project's overall status. For instance, projects should develop a conceptual model that includes defined objectives and hypothesized outcomes. Then create management and monitoring activities that provide thorough evaluation to monitor anticipated results. (BC)

The above case studies, with the "lessons learned" and the charting of stakeholders, agencies, laws and regulations that characterize the political landscape for Elkhorn Slough, provided the foundations for the option analyses that follow in Chapter 7.

* NOEP notes that performance targets should also include policy and economic principles.

# 6 Economic Analyses of the Restoration Options

## 6.1 The Approach

The proposed restoration alternatives for Elkhorn Slough are likely to have different effects on the preservation of salt marsh habitat, the composition of other habitats, tidal scouring, water quality, endangered species, and a number of other dimensions. In some cases these differences are large (e.g. tidal scouring in Alternative 2 compared to the other alternatives) and in other cases, the differences are more subtle (e.g. habitat composition under the various alternative scenarios). The many ways in which economic activities may be influenced by attributes of the Slough and Moss Landing area and what actions would require more efforts and costs for permitting and permissions and reviews were discussed in Chapter 4. Rather than provide a lengthy discussion of how all of the physical changes associated with each restoration alternative affect all legal, regulatory, policy, and economic activities, the following sections discuss what is believed to be the most significant potential effects of restoration upon economic activities in the Elkhorn Slough/Moss Landing area, and which will require the most extensive regulatory and legal efforts.

## 6.2 Commercial and Recreational Fishing

As described elsewhere in this report, the current economy of the Elkhorn Slough/Moss Landing area is one that has developed around the use of a highly marine-influenced estuary system. Under all of the proposed restoration alternatives, the Slough would continue to become deeper and more marine with less salt marsh habitat in the long-run and more subtidal habit. As discussed earlier, the loss of salt marsh habitat is not likely to have a large effect on commercial fishing or commercial passenger fishing, both of which may benefit from increased nursery functions for marine species provided by increases in subtidal habitats.

The alternatives do differ in the degree to which water quality and salinity will be affected in the Slough. Less tidal flushing could lead to water quality impairment and potentially more days of hypoxia under Alternative 2. Alternative 3 is also expected to result in less tidal flushing, but will further impair water quality via less restricted nutrient loads from the Old Salinas River channel.

Flatfish are known to be sensitive to water quality (see section 4.1.1). Flatfish currently account for roughly $0.5 million in landed value annually. The commercial value of the catch of the three flatfish species known to reside in the Slough, however, comprise only a subset of the total flatfish catch, with a maximum landed value of $400,000 in 1997 and less than $200,000 in more recent years. Flatfish have not been important historically in the catch reported by anglers on commercial passenger fishing vessels leaving from Moss Landing.

Alternatives 2 and 3 could have impacts on recreational fishers in other inboard parts of the Moss Landing/Elkhorn Slough area. Fish composition and abundance at Kirby Park common recreational fishing destination in the Slough could be affected by changes in salinity, water quality, and marsh habitat. This risk appears most severe under Alternative 3, as discussed above. Recreational anglers in the Slough do not account for a very large share of recreational and tourism spending. Nevertheless, this activity appears to be especially important for Spanish speaking and Latino visitors; half of all Spanish speaking visitors and 62.5 percent of all Latino

visitors indicated they fished in the Slough or Moss Landing area. While most of these anglers fished in the Moss Landing harbor area, many also visited other parts of the Slough (especially Kirby Park).

Under Alternative 1, the No Action Alternative, recreational anglers within the Slough may benefit from having more and better opportunities to catch marine species within the protected confines of the Moss Landing area. The increased flushing that likely would take place under Alternative 1, especially compared to the other alternatives, would maintain water quality and oxygenation for waters in the Slough, both of which are beneficial to fish species. Alternative 4 is expected to have a similar impact on water quality which could be equally beneficial to recreational anglers.

## 6.3 Nature Tourism and Recreation

The effects of the alternatives on recreational activities are less straightforward. At this time, it is unknown how changes in salt marsh habitat would likely effect recreational users. While 31 percent of all visitors indicated they would come to the Slough less often if there were less salt marsh, 28 percent indicated they would come more often if there were more mudflats and 34 percent would come more often if there were more open water spaces.

Similarly, kayakers and paddlers prefer open water habitat and tidal creeks, but 40 percent of paddlers also indicate they like to paddle near salt marshes. As discussed in 4.1.3, kayakers spent the most money per trip during their visits to Moss Landing/Elkhorn Slough, with group expenditures at $60 per trip. Any significant change in visitation from this group of users could have a perceptible impact on the Slough economy.

The effect of habitat change on nature tourism and recreation will depend on how habitat changes affect birds and otters. It is not known exactly how changes in habitat would affect bird species composition and abundance or how changes in these attributes would affect the frequency of visits by birdwatchers, the economic value they place on birding or how much they spend in the local economy. Also unknown is how changes in habitat will affect the abundance and location of otters and thus the ability of visitors to see otters. Predictions can be made, however, for how the abundance of otter prey species (mudflat invertebrates) might change under each restoration option. Based simply on the extent of suitable habitat at suitable depth, Wasson (2009) has predicted that Alternative 1 will result in increased mudflat invertebrate abundance, Alternatives 2 and 3 will result in mixed impacts on different species, and Alternative 4 will benefit only invertebrates with extensive subtidal distribution (gaper and butter clams and fat innkeeper worms). In addition to habitat considerations, Wasson (2009) has taken into account habitat quality and environmental conditions to predict best and worst case scenarios under each alternative. Looking deeper into these potentially influential factors can therefore complicate predictions for otter prey species under each alternative. Understanding how these factors, in addition to habitat extent, might affect economically important species is extremely important, as bird and wildlife watching are an important draw for visitors; these activities are among the top three reasons (#3 and #1, respectively) that people visit the Slough, according to the Elkhorn Slough Tidal Wetland Project survey.

Nature tourists and recreationists are likely to be effected by restoration alternatives that affect the connection between the Moss Landing Harbor and the Slough. Alternatives 2 and 3b could change where otters congregate in the Slough. These alternatives also would make it impossible for kayakers and paddlers to move easily from the Harbor to the Slough. Since kayakers tend to visit both the Harbor and Slough, this could have a significant impact on paddlesports. It is possible that some of this lost recreational value could be offset by the creation of new paddling opportunities created by the new channel constructed Under Alternative 2. Under both Alternative 3a and 3b, the construction of a sill could create hazardous paddling conditions near the new sill. If tidal flows become too fast under Alternative 1, kayaking in certain areas of the Slough could become increasingly difficult.

Water quality, especially bacterial contamination and harmful algal blooms could also directly affect water contact activities – especially paddlesports and recreational fishing. The maintenance of clean water, from tidal flushing, is likely to benefit all recreational users. Alternatives that reduce tidal flushing (especially 2 and 3b) are likely to have the greatest detrimental impacts on water contact activities.

Beach going could be affected by restoration alternatives. Alternative 2 will result in the direct loss of beachfront when a new mouth is constructed. Alternative 2 also could affect the along-shore transport of beach sediments near the new mouth. Water quality near the new mouth also could be impaired by the discharge of Slough waters. It is unclear how changes in sediment budgets caused by Alternatives 2 and 3a and 3b will affect beach sediments near Moss Landing. Recall from section 4.1.3 that visitors to the two local State Beaches (Moss Landing and Salinas River) may account for up to $12 million in local spending at current levels of attendance. Beach goers are clearly major contributors to the Slough economy; changes in their visitation resulting from water quality or sediment changes will undoubtedly have a local impact.

Parson Slough is not frequented by most visitors to the Slough. As a result, there are likely to be few negative impacts on nature tourism and recreation from Alternative 4. Further, Alternative 4 offers the possibility of creating new salt marsh habitat without affecting the abundance of other habitats in those areas of the Slough already used for largely marine and deep water activities.

A potentially large impact on nature tourism and recreation could come from disruption of access to the Slough caused by restoration-related construction activities. Unlike other differences between alternatives, whose effects are felt far in the future, the alternatives differ substantially in the amount of construction that would be required in the near future. (Because of the phenomenon known as discounting, economic impacts in the present or near future have higher value than similar impacts in the distant future.) Without a clear understanding of the exact disruptions that might be caused by restoration, it is difficult to know just how much recreation and tourism will be affected. Still, it is clear that Alternative 2 will require substantial construction activity as will Alternatives 3a and 3b. Alternatives 1 and 4 are not likely to have a substantial impact on access.

## *6.3 Harbor Activities and Recreational Boating*

The Harbor currently benefits from the natural dredging that occurs due to tidal scouring. There are no substantial, foreseeable direct negative impacts on harbor activity that would occur under

Alternative 1, but the need for dredging (and the costs associated with dredging) could increase under alternatives that result in lessened tidal scouring or greater added sediments (either added directly or through the diversion of local rivers). Dredging costs in an estuary that does not benefit from the magnitude of tidal scouring found at Moss Landing, are nearly double that of Moss landing in nearby Morro Bay–a difference of approximately $0.5 million annually.

## 6.4 Power Plant

The power plant could be affected by the way restoration alternatives affect the maintenance and efficiency of the "once through cooling process" employed by the power plant. The power plant would likely benefit from maintenance of water quality and the current standard of dredging that would be required under Alternative 1 compared to other alternatives. The proposed outcomes for restoration alternatives, as presented by PWA, are not sufficiently detailed to estimate how water quality and sedimentation in the immediate vicinity of the cooling intake will be affected. As one of the largest and most economically important components of the Slough's economy, it is important that there be better estimates of how power plant activity could be affected by these restoration alternatives.

## 6.5 Conclusion

Because the Elkhorn Slough/Moss Landing economy has developed around a marine-influenced estuary, it is unlikely that current economic activity in the area will be affected detrimentally by the changes in habitat, sedimentation, and water quality that are projected under a scenario of no action (Alternative 1). Other alternatives, however, could impact the local economy especially through impacts on the Moss Landing Power Plant, nature and recreation tourism (especially beach going, bird and otter watching, and kayaking) and harbor dredging. Commercial fishing could be impacted to a lesser degree. Other activities are much less likely to be affected by restoration *per se*, but many activities in the area could be affected by the congestion, delay, and loss of access caused by restoration construction.

Of course, one reason for considering restoration alternatives is because salt marsh habitat is so rare in California. Other studies (e.g. Woodward and Wui 2001) have shown that even non-users may place some value on the presence of salt marsh habitat. To date, however, there have been no studies to show empirically how California households would value the protection of salt marsh habitat. Brander et al. (2006) estimate that worldwide, the average economic value generated by a hectare of salt marsh is $385 per hectare. Liu and Stern (2008) examine values from the literature for salt marshes around the world. The authors find that the median value per household for salt marsh is $127 per hectare per year. Neither the studies by Brander et al. (2006) nor Liu and Stern (2008), however, include values estimated for California estuaries. In any case, the restoration alternatives do not differ substantially in the total amount of salt marsh habitat created. Even the most aggressive restoration would result in only 270 more acres of salt marsh in 50 years compared to business as usual estimates for the same period. Ten years after restoration, the most optimistic estimates are for 230 acres more than with business as usual at that time. There is no evidence that the average household in the Elkhorn Slough area, the central Coast, or in all of California would be aware of the differences in salt marsh coverage under the different alternatives.

From an economic perspective, none of the proposed restoration alternatives offer a clearly superior outcome than the business as usual alternative of no action. Alternatives 2, 3a, and 3b, however, could potentially result in short and long-term losses for a number of economic activities in the area. Restoration is rarely undertaken in order to maximize the net economic value of an estuary or marsh. Please note, these findings do not suggest that restoration should be taken off the table. Instead, to understand the full costs of restoration, more work needs to be done to determine how restoration alternatives will affect these economic activities. If proposed restoration alternatives do result in economic losses to local businesses, Elkhorn Slough visitors, or others, these costs need to be added to those already estimated for the costs of construction. Together, these non-market, market, and direct costs of construction ought to be considered when determining the true costs of restoration.

# 7 Policy Analyses of the Restoration Options

## 7.1 The Approach

As part of the Elkhorn Slough EBM project, PWA was hired to produce hydrologic models of large and small scale strategies for stabilizing the erosion occurring in the Elkhorn Slough. PWA produced a report with four alternatives: a large scale construction project that changes the outlet for the Slough, the mouth of the Salinas River and requires significant changes to Highway 1, placement of a large sill at the mouth of the Slough, a small scale option of placing a small sill at an opportune place to slow the growth of the tidal prism at the mouth of the Slough, and no action. This chapter uses these four options as the framework for analysis regarding policy.

The policy analysis that follows considers the lessons learned from the case studies and the political structure that frames the entire watershed of the Elkhorn Slough. The assumptions underlying this analysis include:

1. The determination whether a marine or salt marsh environment is a more desirable environmental for Elkhorn Slough does not have a straightforward answer. Rather the decision is subject to one's perspective and preferences.
2. Sea level rise resulting from greenhouse gas emissions will likely affect all of the options within the next forty years.
3. No single legal entity oversees the entire Slough watershed, so any option that is expansive and affects the entire area, will require the formation of a special body to oversee the activity or a separate legal agreement that covers all involved parties.
4. The degree of detail of submitted evidence of potential impacts from restoration options is uneven so that some information, such as nutrient load is excellent, but the hydrodynamic models for sills and the large option that changes the mouth are not refined enough for conclusive recommendations.

The chapter presents each restoration alternative individually using lessons learned from the case-study results, anticipated regulatory requirements, and laws applicable to each option.

## 7.2 Alternative 1 – No Action

The No Action alternative (Alternative 1) assumes that land managers take no measures that would affect the current tidal erosion and wetland loss occurring at Elkhorn Slough (PWA 2008). However, this alternative is independent of other restoration projects within the Slough and considers the environmental consequences of not undergoing any restoration and measures under erosive Slough conditions. The No Action alternative is important because it sets a baseline for measuring improvement by the other restoration options.

When considering the short-term impacts on local policy and economics, the No Action alternative would require Slough managers to continue to remain in compliance with current regulations, and not face additional regulatory measures. This would be a "business as usual" option. Long-term habitat changes from salt marsh to mud flats and a more extensive marine environment could influence businesses and certain industries in the future. The following sections describe the ecological, economic, and policy implications of the No Action alternative.

### 7.2.1 Ecological Outcomes

Converting the original Elkhorn Slough tidal trajectory altered historical ebb and flow patterns (Peichel, B. et al.) (figure 34). Many scientists and ecologists express that these new tidal and freshwater patterns as erosive forces can cause irreparable damage to the Slough. The current levels of tidal scour erosion have decreased salt marsh and estuarine diversity. According to the Elkhorn Slough Tidal Wetland Strategic Plan, human activities degraded half of the original tidal marsh. These impacts create persistent habitat loss, negative water quality impacts, increased pollution and invasive species, and eutrophication.

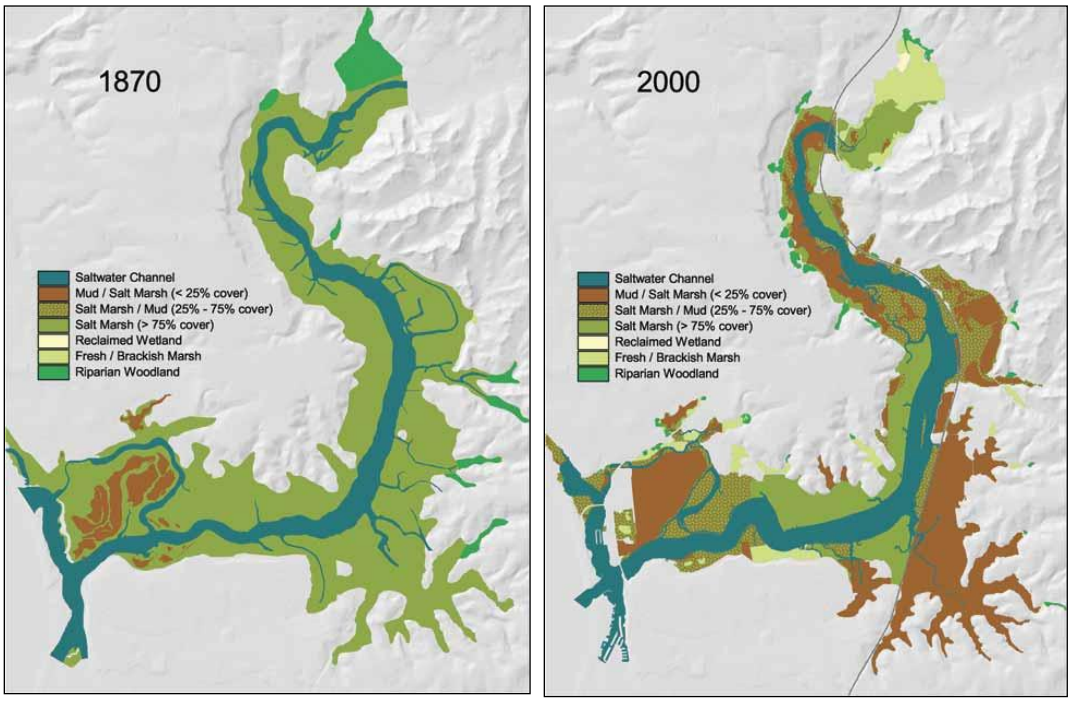



**Figure 34 Historical habitat changes in the Elkhorn Slough 1870-2000**

The maps above show the gradual conversion over the past 130 years of salt marsh to mudflats cause by human disturbance. The trend is predicted to accelerate in the future without any physical intervention. The Elkhorn Slough scientists estimate that erosion causes 73,250 cubic yards of sediment to wash out into the Monterey Bay (Peichel, B. et al.). In addition, the Slough's banks erode one to two feet per year, impacting local flora and fauna. These rapid changes not only affect the estuary's animals and plants, but also impact neighboring private lands with possible salt-water intrusion as the bay inundates increasing areas of the marsh, public access sites that will be flooded increasingly over time, and railroad and road infrastructure that will have to be monitored to ensure there is no danger of collapse or harm to people.

### 7.2.2 Policy Implications

Choosing the No Action alternative results in avoidance of additional regulatory compliance measures associated with the other restoration options. Current regulations remain in place and estuary managers must continue observing the rules governing the Slough.

## *7.3 Alternative 2 – New Ocean Inlet*

Alternative 2, the large-scale alternative, diverts the existing channel and establishes a new ocean inlet near to its historic location in 1943, slightly north of the current inlet. The new ocean inlet extends into the Lower Bennett Slough and from the old Salinas River mouth as it was in 1943. The new channel connects the new inlet, extending along the north and east sides of the CDFG Wildlife Management Area, and joins the Slough approximately 1 km east of the Highway 1 bridge. This alternative requires both a dam under the existing Highway 1 bridge to block tidal exchange between Elkhorn Slough and Moss Landing Harbor, and construction of a new bridge where Highway 1 crosses the proposed channel.

### 7.3.1 Ecological Outcomes

PWA predicts that creating a new ocean inlet would result in significant ecological improvements for Elkhorn Slough (PWA 2008). According to the report, a new ocean inlet would decrease the velocity of the tidal currents resulting in less channel erosion. The report also indicates that this restoration option will repair the marsh plains and subtidal habitats.

Although the purpose of the new ocean inlet is to restore balance and maintain ecological vitality in the Elkhorn Slough, some concerns have been raised about the impacts on certain threatened wildlife species. A recent study indicates that the California sea otter may experience adverse impacts during the construction process. Specifically, the proposed dam under Highway 1 could be very disturbing to otters and cause them to flee an area, since proximity to human activities and loud noises are disturbance factors. It is possible that the construction could divide otter families (McCarthy 2009). Developing the new channel north of the Slough on DFG State Land raises additional concerns about disturbing endangered Western Snowy Plover habitat (Oliver 2008). Overall, specific mitigation measures need careful consideration to avoid impacting protected species and their habitat.

### 7.3.2 Policy Implications

The large-scale alternative activities will require numerous regulatory and legal permissions, agency consultations, and cooperation and collaboration among all those involved. This section outlines potential legal impediments, regulatory compliance measures, and policy issues that could emerge during the planning process. Additionally, this chapter provides lessons learned from the case-studies that will serve to guide restoration managers if Alternative 2 is chosen. Since Alternative 2 is the largest and most complex option in terms of planning, implementation, environmental changes, and monitoring; the policy information provided in the following sections outline anticipated challenges and describes the regulatory process. This option is by far the most difficult and most costly to implement, and possibly not worth the effort that could take so long that irreparable damage would already have occurred before the project could get underway.

Large-scale restoration projects, such as Alternative 2, expand the number of regulatory requirements and parties involved. When working with multiple entities, decision-making becomes more difficult as each step of the process must pass through sometimes lengthy and complex protocols. The decision-making process is already underway and the desire to restore the Slough has been recognized by experts for many years. The implementation phase poses significant time delay issues because receiving permits and providing necessary documentation

is expensive and can take years to complete (i.e. feasibility studies, environmental impact reports, etc.). The environmental impacts worsen as tidal scour continues degrading the estuary during the time spent complying with legal and policy processes. This policy analysis on Alternative 2 is intended to make the policy processes move faster, increasing the environmental benefits. Also, this analysis of Alternative 2 requires discussion about how agencies have performed in previous cases of similar projects. The following analysis is not comprehensive and may omit some agencies and steps in the process. It is, however, a realistic appraisal of the probably actors and actions required to carry out this alternative.

#### 7.3.2.1 Required Permissions

Alternative 2 would require a number of permits to comply with regulations. Restoring Elkhorn Slough to the original inlet will have physical impacts and change estuary conditions spanning several jurisdictions among agencies, organizations, and private landowners. In order to legitimately implement this alternative, managers will need to anticipate all of the potential impacts and receive permissions and consultations from the proper entities (table 24).

**Table 24 Applicable regulations for Alternative 2**

| Regulations/Authorities | Permissions Required | Consultation Required |
|---|---|---|
| Federal Endangered Species Act | √ | √ |
| Clean Water Act Section 404 | √ | |
| Clean Water Act Section 401 | | √ |
| National Environmental Policy Act | √ | √ |
| Fish and Wildlife Co-ordination Act | | √ |
| The Migratory Bird Treaty Act | | √ |
| National Marine Sanctuary | | √ |
| National Marine Sanctuary Act | | |
| ESNERR-**NOAA** | √ | √ |
| California Endangered Species Act | √ | |
| California Environmental Quality Act | √ | √ |
| Fully Protected Species and Species of Special Concern | √ | √ |
| CDFG Code Section 3503 | | √ |
| CDFG Code Section 1602 | | √ |
| Porter-Cologne Water Quality Control Act | | √ |
| California Coastal Act | √ | √ |
| Moss Landing Harbor District Ordinance Code | √ | |
| Caltrans | √ | √ |
| Union Pacific Railroad | √ | √ |
| County Zoning and Ordinances* | √ | |
| * County zoning and ordinances require several construction permits. | | |

### 7.3.2.2 Local and Regional Regulations

At the local and regional level, various provisions and codes regulate land use and protect interested parties and stakeholders. Monterey County, MLHD, Caltrans and others will likely be involved in the policy process when considering changes to tidal flow and Highway 1.

The zoning and building codes, general plans, specific plans, and other planning and building policies of Monterey County or Moss Landing would apply to Alternative 2. Project development activities would fall under Title 20 Zoning Coastal Implementation Plan, the Monterey County General Plan, Monterey County Local Coastal Plan, and the North County Land Use Plan. Each document contains a list of planning and development standards that must be met through presentation of thorough project evaluation and analysis. The construction activities under Alternative 2 warrant permissions that will ensure compliance with each of the Land Use, Coastal, and General Plans.

The MLHD serves commercial and recreational fishermen and residents of the North County and Greater Salinas areas. Construction permits under the MLHD Ordinance Code (Section 26.300) may be required for Alternative 2 restoration activities in and surrounding the harbor. The ordinance requires construction permits for structures not affixed to the land and in this case, since the dam under Highway 1 Bridge is a permanent structure, it may fall under the MLHD's construction permitting authority.

Any alteration, creation, or impediment of a roadway is subject to a set of transportation- related laws and regulations with associated permitting processes. Alternative 2 would fall under this section with additional rules regarding bridges. Constructing a new bridge or modifying existing bridges requires authorization by the U.S. Coast Guard. Any structure developed over a navigable waterway requires a Rivers and Harbors Act, Section 10 permit from the Corps. Caltrans requires encroachment permits for any activity occurring within the right-of-way. In addition, the project would need to comply with other local municipality guidelines and permissions regarding activities on roadways.

The change in tidal flow under Alternative 2 may affect the adjacent railway and require special agreements with the Union Pacific Railroad. Since the railroad may experience potential impacts resulting from the restoration activities, permissions granted by the railroad company will help to avoid any legal challenges to the restoration alternative. Permission by Union Pacific may require mitigation measures that protect the railway.

#### 7.3.2.3 State Regulations

The State of California has stricter regulations than the federal rules governing the environment and several apply to the second restoration alternative. The major environmental alterations resulting from this alternative can result in great benefits; California's regulatory system will monitor and ensure that construction standards uphold healthy environmental quality and conditions.

CEQA informs governmental decision makers and the public about potentially significant environmental effects of proposed activities (Fish & Game Code §2050, et seq). Secondly, CEQA identifies mitigation strategies that avoid or significantly reduce environmental damage. CEQA can change the outcome of the restoration project by requiring changes, using other feasible alternatives, and/or mitigation measures. Finally, CEQA discloses the environmental impacts allowing public input from any interested parties. CEQA applies to Alternative 2 since it is a project "undertaken, funded or requiring an issuance of a permit by a public agency" (PWA 2006). Project analysis is presented in a formal document depending on the scale of project impacts using an EIR, EIS, Negative Declaration, or Environmental Assessment.

Rerouting the mouth will be subject to CEQA provisions since it is a project that has a potential for resulting in physical change to the environment and is contingent on several discretionary approvals by governmental agencies. The construction of a dam under Highway 1 bridge, developing a new bridge, and diverting the existing Elkhorn Slough channel would require an EIR. This is a detailed report written by the lead agency describing and analyzing the significant environmental effects of the proposed restoration project activities. This document would also identify alternatives and discuss ways to reduce or avoid the possible environmental damage. An EIR is likely to take at least one year to complete if all information is available. Required biological and engineering analyses addressing the technical components of Alternative 2 could further delay the EIR process.

CDFG has jurisdiction over threatened or endangered species formally listed by the State under the CESA (California Public Resources Code Section 21000 et seq.). CESA is similar to the ESA

both in process and substance, providing additional protection to threatened and endangered species in California (PWA 2006). Species may be listed as threatened or endangered under both the state and federal endangered species acts, in which case the provisions of both state and federal laws apply. The California endangered species laws prohibit the take[15] of any plant or animal listed as endangered, threatened, or rare, even when incidental take is permitted under the ESA.

As one of the landowners, CDFG ensures that interim and long-term restoration actions meet CESA compliance standards, although CDFG does not need to issue itself a CESA permit (PWA 2006). Alternative 2 would necessitate endangered species consultation with CDFG due to the alteration of threatened or endangered species habitat in the Slough.

In addition, CDFG maintains a list of Fully Protected Species and an informal list of Species of Special Concern. Fully Protected Species cannot be harmed or possessed at any time, of which many species are also listed threatened or endangered (PWA 2006). Since the Brown pelican and Southern sea otter are listed, special consideration would need to be met in order to ensure that the species are not adversely impacted as a result of Alternative 2. Species of Special Concern are broadly defined as wildlife species that are of concern to the CDFG because of population declines and restricted distributions, and/or they are associated with declining habitats in California. In addition to being listed as threatened, the Western snowy plover, which inhabits the area where the new channel would be diverted under Alternative 2, this bird is listed as a Species of Special Concern. Impacts to species of special concern may be considered significant under CEQA triggering special project mitigation measures or other alternatives.

According to Section 3503.5 of the California Fish and Game Code (Protection of Nesting Birds and Raptors), it is unlawful to take, possess, or destroy any birds of prey or to take, possess, or destroy any nest or eggs of such birds. Active nests of all other birds are similarly protected under Section 3503 of the California Fish and Game Code, as well as birds designated in the International MBTA under Section 3513 of the California Fish and Game Code. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "take" by CDFG. Although this statute does not require the issuance of an incidental take permit, Alternative 2 project activities would need to avoid disturbance to nesting birds.

All diversions, obstructions, or changes to the natural flow, or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFG, pursuant to Section 1602 of the California Fish and Game Code. Section 1602 states that it is unlawful for any person to substantially divert or obstruct the natural flow, or substantially change the bed, channel, or bank of any river, stream, or lake designated by CDFG, or to use any material from the streambeds, without first notifying CDFG of such activity. Since the flow of the Slough will substantially change under restoration Alternative 2, project managers will notify CDFG about stream alterations.

The regulatory definition by the of a stream is a body of water that flows at least periodically or intermittently through a bed or channel that has banks and supports fish or other aquatic life

[15] From Section 3(18) of the Federal Endangered Species Act: "The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

(State Water Resources Control Board). This includes watercourses with a surface or sub-surface flow that supports or has supported riparian vegetation, which sparsely surrounds the Slough. CDFG's jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife. CDFG is charged with ensuring that interim and long-term restoration actions comply with the Fish and Game Code, Alternative 2 may require a Section 1602 permit.

Projects that affect wetlands or waters must also meet waste discharge requirements of the RWQCB under California's Porter–Cologne Water Quality Control Act (California Public Resources Code section 13000 et seq). This Act gives RWQCB authority to regulate the 'discharge of waste' to 'waters of the State'. Discharges of waste include fill or material resulting from human activities. It is important to note that, while Corps Section 404 permits and RWCQB 401 certifications are required when the activity results in fill or discharge directly below the ordinary high water line of waters of the United States, any activity that results or may result in a discharge that directly or indirectly impacts waters of the State or the beneficial uses of those waters are subject to water discharge requirements (PWA 2006). The water discharge requirements may be applied to the Elkhorn Slough restoration project under Alternative 2, depending on the ultimate project design and use of fill materials.

The CCC regulates the use of land and water in the coastal zone in accordance with the Coastal Act (California Public Resources Code section 30000 et seq). The Coastal Act includes specific policies that address issues such as shoreline public access and recreation, lower cost visitor accommodations, terrestrial and marine habitat protection, visual resources, landform alteration, agricultural lands, commercial fisheries, industrial uses, water quality, offshore oil and gas development, transportation, development design, power plants, ports, and public works.

Development activities in the coastal zone typically require a coastal development permit from the CCC or in instances where local government has developed an approved LCP, from the local governing agency. The Elkhorn Slough restoration project alternatives that fall within the coastal zone are within the jurisdiction of the CCC. Therefore, a Coastal Development Permit may be issued by the CCC following their review.

#### 7.3.2.4 Federal Regulations

The federal regulations serve as the baseline for state, regional, and local standards. Alternative 2 requires the work and consultation of federal agencies whose jurisdictions intersect the restoration project lines. In addition, Alternative 2 activities would require permitting and compliance with particular federal environmental regulations.

NEPA directs all federal agencies to give appropriate consideration to the environmental effects of their decision making and to prepare detailed EIS on recommendations or reports on proposals for legislation and other major federal actions significantly affecting the quality of the environment (Public Law 91-190).

If any federal agencies are involved either in the funding or physical actions associated with the Elkhorn Slough restoration and the project is considered to have actions significantly affecting

the quality of the environment, then the project will require NEPA documentation. It is likely that the large-scale activities involved in Alternative 2 would require NEPA documentation if the lead agency on the project is federal. In the case of Alternative 2, if the Corps became involved as a funding source, they may be eligible for becoming the lead agency and this would require the preparation of an EIS. A joint Environmental Impact Report and Study (EIR/EIS) combining the reports is possible under provisions of CEQA. This would consist of state and federal agencies co-writing one environmental impact analysis of the chosen restoration project.

Both NOAA Fisheries and FWS share responsibility for administration of the ESA (Public Law 93-205). The ESA protects listed wildlife species from harm or take. An activity is defined as a take even if it is unintentional or accidental. Individuals planning to conduct any activity resulting in the take of an endangered or threatened species, whether or not deliberate, must possess an Incidental Take Authorization Permit to perform that activity. This permit would consist of a Biological Opinion and Incidental Take Statement which must establish that the proposed take would not jeopardize the continued existence of the endangered or threatened species.

Issuance of an Incidental Take Authorization may occur either under Section 10(a) of the ESA for projects that have no other federal involvement, or under Section 7 of the ESA for projects that require funding or permits from other federal agencies. Elkhorn Slough restoration Alternative 2 would likely require a Clean Water Act Section 404 permit from the Corps and also Section 7 consultation between the Corps and FWS and/or NOAA Fisheries for any federally listed endangered and threatened species identified in Elkhorn Slough.

The Migratory Bird Treaty Act (16 USC 703–711) prohibits the take of any migratory bird or any part, nest, or eggs of any such bird (Public Law 95-616). Under the act, take is defined as pursuing, hunting, shooting, capturing, collecting, or killing, or attempting to do so. Additionally, Executive Order 13186 (January 11, 2001) requires that any project with federal involvement address impacts of federal actions on migratory birds with the purpose of promoting conservation of migratory bird populations. The Executive Order requires federal agencies to work with FWS to develop a memorandum of understanding. Restoration Alternative 2 would have long-term, positive impacts on the habitats of migratory bird species. However, if short-term construction activities adversely impact or result in a take of a migratory bird species then the involved federal agencies would need to prepare a memorandum of understanding.

The Corps is responsible under Section 404 of the CWA for regulating discharges of fill or dredged material into waters of the United States (Public Law 93-205). U.S. waters and their lateral limits are defined in 33 CFR (Code of Federal Regulations) Part 328.3(a) and include streams that are tributary to navigable waters and adjacent wetlands. Wetlands that are not adjacent to U.S. waters are termed ‘isolated wetlands’ and may be subject to Corps jurisdiction if they have a hydrological connection to waters of the United States. In general, either a nationwide or individual section 404 permit must be obtained before placing fill or dredging in designated wetlands or other waters of the nationwide permits are authorized for certain categories of projects that are deemed to have minimal impacts on aquatic resources. NEPA review is required for each nationwide permit, although once established, project specific NEPA

compliance is not required for subsequent actions. The EPA and FWS are responsible for reviewing permit applications and making approval determinations.

Dredging activities, particularly of the beach at the mouth of the Slough, will require a Section 404 permit. The type of permit required, nationwide or individual, depends on the amount of acreage involved and the end purpose of any proposed fill.

Section 401 of the federal CWA specifies that states must certify that any activity subject to a permit issued by a federal agency, such as the Corps, meets all state water quality standards (Public Law 93-205). The RWQCB is regionally responsible for certifying actions for activities subject to any permit issued by the Corps pursuant to Section 404 (or for any other Corps permit, such as permits issued pursuant to Section 10 of the Rivers and Harbors Act of 1899). Actions may include issuance of a 401 certification noting that the activity subject to the federal permit complies with state water quality standards, issuance of a conditional 401 certification, and denial of 401 certification. In instances where the 401 certification is denied, the associated federal permit is also deemed denied.

Alternative 2 may require consultation with the RWQCB pursuant to Section 401. Other wetland restoration projects on the Central Coast have been subject to stringent Section 401 requirements regarding surface water quality.

The MBNMS prohibits activities that dredge or deposit any part of the seabed within the Sanctuary (Title 15, CFR Section 922.132). The development of a new inlet will require dredging permits upon MBNMS review since the construction will occur adjacent to the Sanctuary.

ESNERR encompasses about 1400 acres on the south and east side of Elkhorn Slough under the jurisdiction of CDFG. One of the big threats to the Elkhorn Slough is the degraded Slough habitats. The Reserve facilitates and encourages research on many topics, one of large importance is restoration ecology of degraded Slough tidal habitats. A permit is required for any research done within Elkhorn Slough Reserve.

#### 7.3.2.5 Regulatory, Institutional, and Finance Issues – Lessons Learned

The case-studies examined for this report present suggestions by project managers to overcome particular regulatory, institutional, and financial setbacks throughout the restoration process. This section discusses lessons learned that are relevant to Alternative 2, creating a new ocean inlet. Estuary managers should give special consideration to the comments if moving forward with this option, as it provides insight about how to best strategize and prepare for policy-related issues of a large-scale restoration project.

Certain agencies can cause delays in acquiring permits necessary to allow some restoration actions to occur on schedule. In the Bolsa Chica restoration case, significant delays resulted from the failure to produce the public notice in a timely fashion, and other postponements occurred because agencies lagged in providing particular permits. Some of these delays can be avoided by submitting the permit applications early in the process. For instance, the Corps section 404

permit was sought early, and the twelve month delay did *not* postpone commencement of the restoration. The project lead noted that permitting agencies would intentionally slow the permitting process. For instance, the Caltrans delayed permit approval when attempting to persuade the project managers broaden their proposal to include widening the Pacific Coast Highway from four lanes to six lanes for two miles near the project site, an action unrelated to the restoration objectives. If the decision makers select Alternative 2, managers may want to seek permits early, allowing certain project activities to move forward, while the approval process for other activities continues – avoiding unnecessary project delays.

Decision-making requires complex internal consensus building among various stakeholders and different agencies at all levels of government so that expectations are understood by all parties. Throughout the Napa-Sonoma restoration project, regulators, landowners, and other groups exhibited significant differences of opinion regarding project direction. Specifically, disagreements arose when determining the amount of public access to require, as well as over concerns and uncertainties about pollution associated with marsh restoration. These mismatches between expectations and outcomes created a severe schedule lag-time at all stages (planning, implementation, monitoring and evaluation). The main lesson learned for future restoration projects is that original expectations must be tracked forward and discussed in context of actual outcomes, incorporating best professional judgments combined with all monitoring data to explain whether expectations are being met or not. The results provide new insight for future design and performance criteria. Alternative 2 will face a similar predicament since it involves many stakeholders and many stages. If the objective is to stabilize erosion and to restore marsh, managers should emphasize the original intent of restoring marshland if conflicts of interest arise.

The complicated nature of coordination between Napa-Sonoma restoration project managers and the Corps warrants an individual analysis in terms of what lessons can be learned. Alternative 2 has a large enough scope that incorporating the Corps from the beginning is a viable option, as either a participant or probably as a lead agency with deep enough pockets to help fund the effort.

In the case of Napa-Sonoma, bureaucratic procedures and formalities led to major funding uncertainties, lost time resulting from required analyses (incremental cost analyses, real estate, etc.), and time consumed in the review process by Corps divisions, headquarters, and Assistant Secretary of the Army's office. The Coastal Conservancy and the CDFG might have chosen to do the project without the Corps. The project manager noted that federal involvement should pay off in terms of dollars provided, but slows the project planning considerably and adds costs to the planning effort (Hutzel 2007). Partnerships and Feasibility Studies should only be conducted with the Corps when the cost of the project is too great for the non-federal agency to bear. Although certain restoration activities at Napa Sonoma would not have been completed without the cost share. Therefore the large-scale and high costs were worthwhile to partner with the Corps, even with the added time constraints and bureaucracy.

The Morro Bay restoration project also provides important insights regarding Corps complexities and challenges with a large-scale restoration project. As described above, the restoration activities halted due to increased costs, time limitations, and technical problems. The majority of

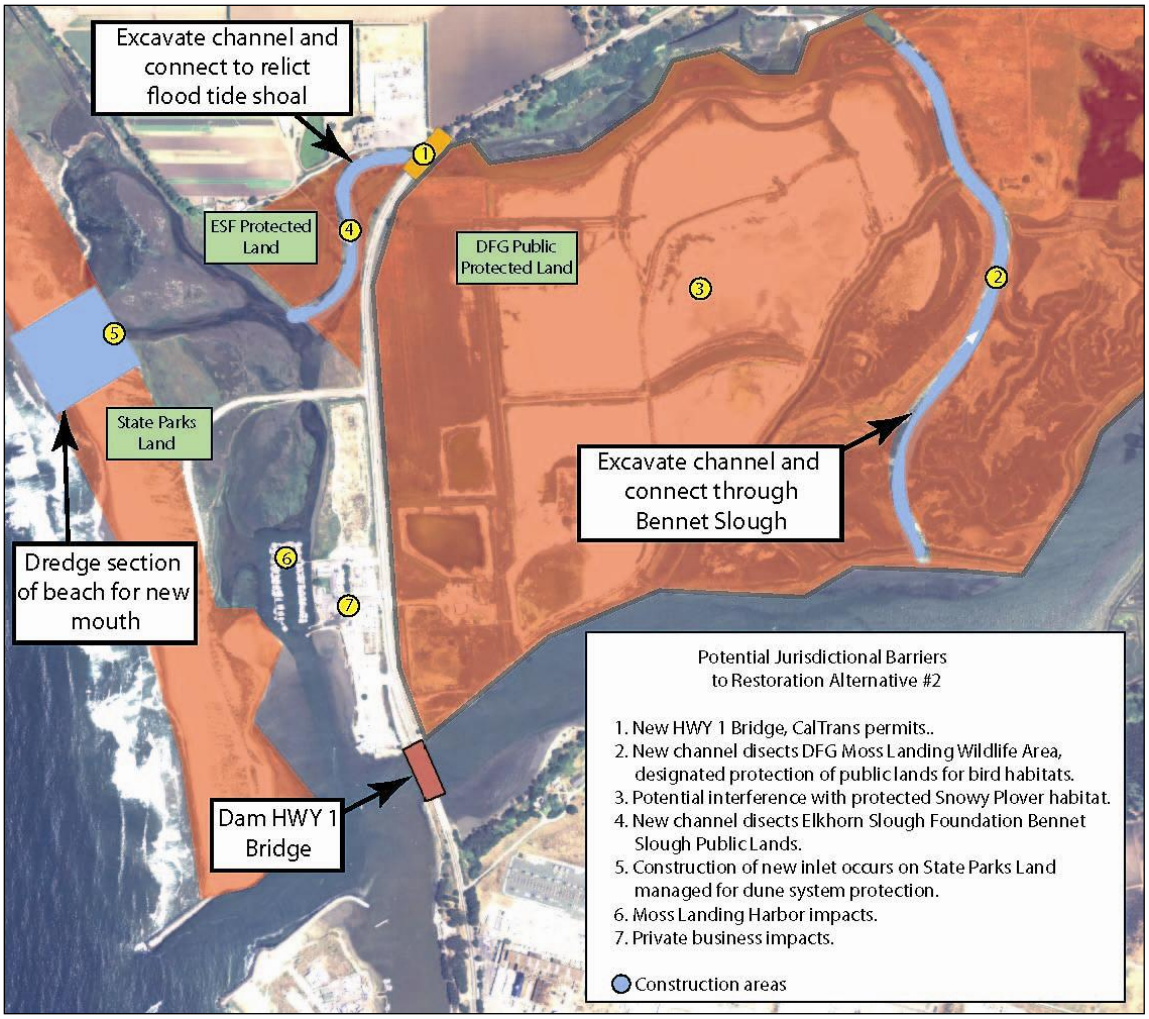
difficulties at Morro Bay arose from coordination efforts between the lead agency and the Corps. A number of challenges ensued regarding product quality, scheduling, and budgeting (Berman 2007). In addition, the federal funding process presents appropriation uncertainties, which may not ensure annual appropriations to the project and potentially hinder success. Although certain projects may necessitate Corps assistance, the project manager pointed out that assessment work can be handled internally by hiring consultants to determine the course of action. If overwhelming financial assistance is needed to implement Alternative 2, then request support from the Corps.

Overall, the project leaders for Alternative 2 should provide regulatory agencies every opportunity to participate and stay informed in project planning and design. This communication with participating agencies will help ensure that they receive all updated and available information and subsequently addressing their concerns. This is the pre-emptive approach and creates fewer impediments during the policy process.

Finally, project managers should establish more specific and interim targets. These targets should have defined thresholds that indicate whether changing current actions would be appropriate. These targets would supplement preliminary and 20-year goals, serving to guide the in-between period. Ensuring that performance targets are not only based on scientific principles but also adequately reflect public expectations. Since the Elkhorn Slough is a highly visited attraction among kayakers, wildlife viewers, and other recreation seekers, performance criteria should include local business impacts and tourism.

#### 7.3.2.6 Other Areas of Legal and Political Concern

Over the course of the planning process, stakeholders and Tidal Wetlands Project team members have raised environmental concerns that have political ramifications. Many impacts resulting from the construction and locations of the large-scale restoration activities may adversely affect wildlife and habitats. The legal protections for designated habitats, endangered species, and public lands allow interested groups and individuals to challenge the actions of the proposed alternative. Figure 35 displays a map of the restoration area that highlights the major restoration actions, overlays the jurisdictions, and notes stakeholder issues.




*Source: PWA*

**Figure 35 Selected impacts on protected lands**

The issues presented in figure 35 represent selected concerns raised by stakeholders during the planning process. Significant questions surround whether the project would be able to obtain encroachment and transportation permits by Caltrans (#1). Another area of concern is that lands bought for and held in the public trust will be disturbed by the construction activities, which could bring about lawsuits (#2,4, and 5). These lands include CDFG public lands, land owned by the Elkhorn Slough Foundation, and State Park Land. Additionally, potential for disturbing critical habitat of endangered species will raise Endangered Species Act issues. Harbor and private industry impacts have political implications and may create strong opposition to the project (#3). And finally, significant issues have been posed about whether damming the Highway 1 bridge will impact the harbor and the businesses that depend on the harbor (#6,#7).

Other preliminary designs of Alternative 2 show that the path of the new inlet can span several other jurisdictions, requiring more permissions (figure 36). The project design should minimize disturbance to lands not owned by the government or Elkhorn Slough Foundation. The drawing shows the excavation touching the Capurro property and the main branch of the Packard property. The project footprint could be shifted to avoid those parcels if necessary.

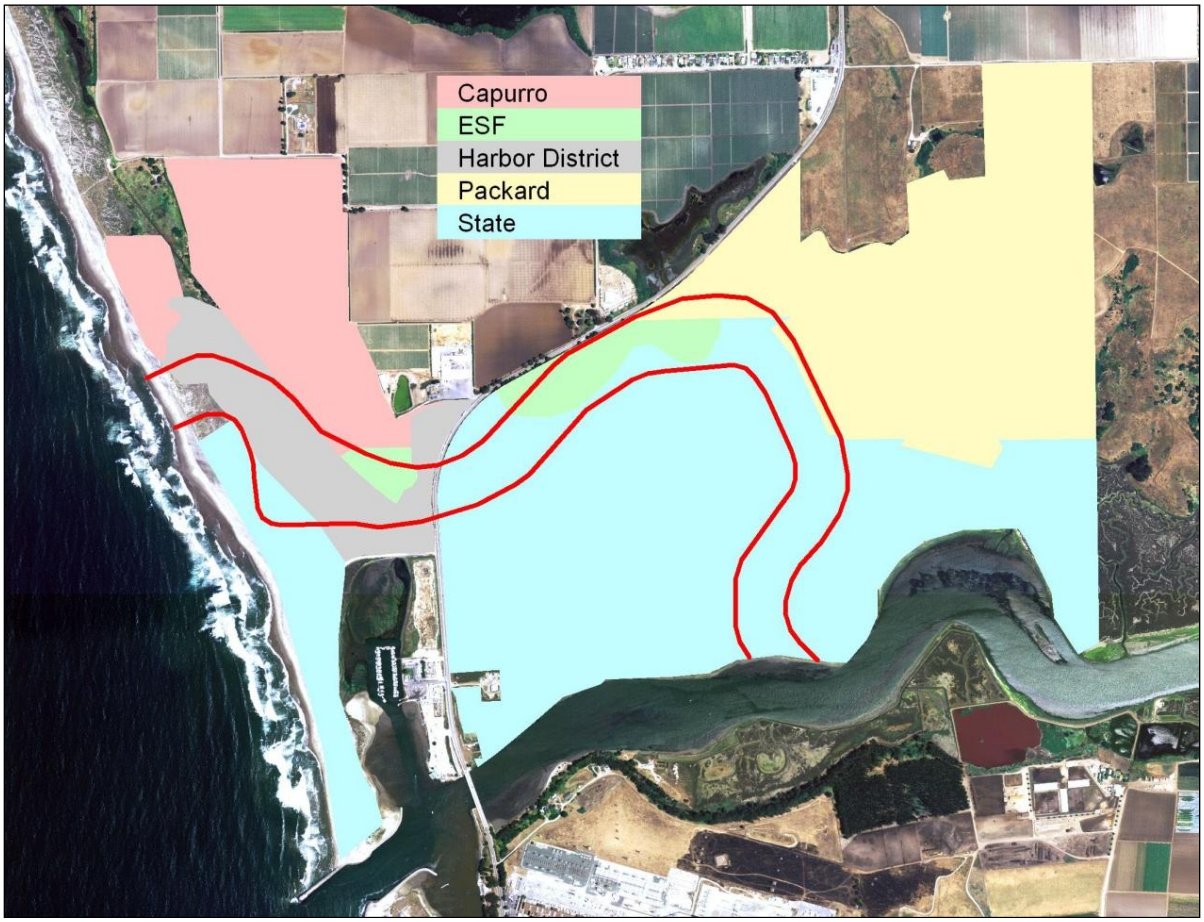
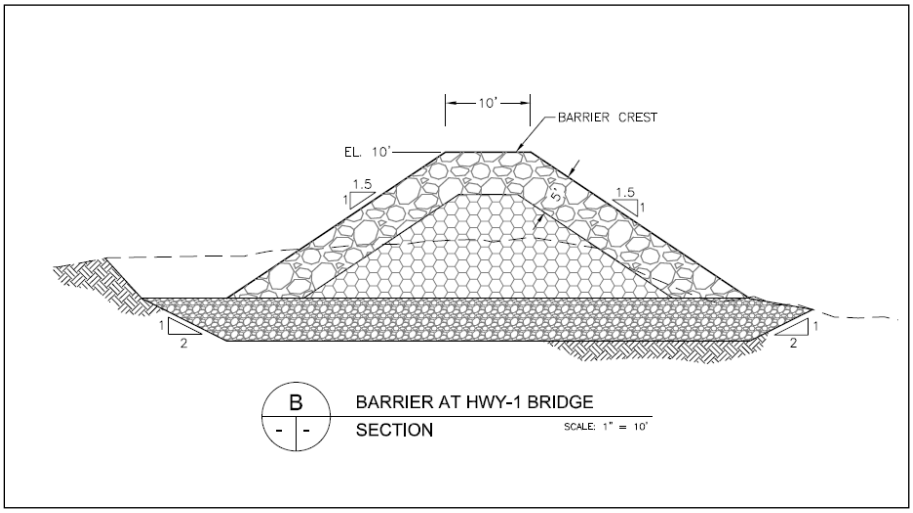



**Figure 36 Preliminary design of affected jurisdictions under Alternative 2**

## 7.4 Alternative 3 – Tidal Barrier Under Highway 1

Alternative 3 includes two scenarios for the construction of a partial tidal barrier, referred to as a sill, at the Highway 1 bridge. Implementation of this alternative would reduce tidal exchange between the Slough and Moss Landing Harbor but not eliminate this hydraulic connection. The sill would perform a similar function to the historic shoaling inlet by reducing tidal exchange. PWA conducted hydrological and engineering analysis on both a high and low sill option. Discussions occurred proposing other configurations between the two sill options and the prospect of a mechanical sill that can adjust the height. Figure 37 provides the schematics of the possible high sill option and figure 38 is a photo that illustrates an example of a similar tidal barrier.




*Source: PWA*

**Figure 37 Engineers rendering of the large sill at Highway 1**

*Source: www.hydrobarriers.com*

**Figure 38 Photo of a large sill, China**

### 7.4.1 Policy Implications

The sill alternative raises a number of legal and regulatory considerations. Environmental impacts resulting from the construction process of a sill are significantly less than those outlined in Alternative 2, although many of changing dynamics resulting from the placement of a tidal barrier at Highway 1 require government permissions and stakeholder consultations. Consistent with the framework of this report, related case studies provide input to estuary managers for optimizing efficiency throughout the political process. Legal, regulatory, and policy information provided in this section should help guide decisions for the planning and preparation for the implementation of Alternative 3.

### 7.4.2 Required Permissions

Regulations governing environmental impacts, waterways, sediment processes, and local standards affect the development of Alternative 3. Placing a tidal barrier at Highway 1 will have physical impacts and change conditions for agencies, organizations, and private landowners. In order to legitimately implement Alternative 3, managers will need to anticipate all of the potential impacts and receive permissions and consultations from the proper entities (table 25).

**Table 25 Applicable regulations for Alternative 3**

| Regulations/Authorities | Permissions Required | Consultation Required |
|---|---|---|
| Federal Endangered Species Act | √ | √ |
| Clean Water Act Section 404 | √ | |
| Clean Water Act Section 401 | | √ |
| National Environmental Policy Act | √ | √ |
| Fish and Wildlife Co-ordination Act | | √ |
| National Marine Sanctuary | | √ |
| ESNERR | √ | √ |
| California Endangered Species Act | √ | |
| California Environmental Quality Act | √ | √ |
| Fully Protected Species and Species of Special Concern | √ | √ |
| CDFG Code Section 1602 | | √ |
| Porter-Cologne Water Quality Control Act | | √ |
| California Coastal Act | √ | √ |
| Moss Landing Harbor District Ordinance Code | √ | |
| Caltrans | √ | √ |
| County Zoning and Ordinances | √ | |

### 7.4.3 Local and Regional Regulations

The tidal barrier construction under Alternative 3 is pursuant to the local and regional level codes and standards, and various provisions that regulate land use and protect interested parties and stakeholders. The same local and county level plans produced by Monterey County and the MLHD that regulate all development would be involved in any significant restoration at Elkhorn Slough, including Alternative 3. Caltrans among the regulatory bodies will likely be involved in the policy process when considering changes to tidal flow under, and alteration of the Highway 1 bridge.

Alternative 3 would be subject to all zoning and building codes, general plans, specific plans, and other planning and building policies of Monterey County. Development activities would fall under Title 20 Zoning Coastal Implementation Plan, the Monterey County General Plan, Monterey County Local Coastal Plan, and the North County Land Use Plan. Each document contains a list of planning and development standards that must be met through presentation of thorough project evaluation and analysis. Permits would be authorized for the implementation of Alternative 3 for each of the Land Use, Coastal, and General Plans.

Harbor District Ordinance Code (Section 26.300) requires construction permits for structures not affixed to the land and in this case, since the sill under the Highway 1 bridge is a permanent structure, any change would likely need a construction permit. Alternative 3 may also require additional consultation and engineering analyses to address sediment accumulation. Dredging, filling, and water quality impacts require other state and federal permits discussed in greater detail in the following sections.

Restoration Alternative 3 would require permissions by Caltrans since the agency mandates that any alteration, creation, or impediment of a roadway will be subject to a set of transportation related laws and regulations with associated permitting processes. Caltrans also requires encroachment permits for any activity occurring within the right of way. Alternative 3 requires encroachment permits if the sill construction impedes traffic on the highway during construction. In addition, the project would be responsible for complying with other local municipality guidelines and permissions regarding activities on roadways.

### 7.4.4 State Regulations

Tighter state regulations govern the environmental impacts caused by the sill. The major environmental alterations resulting from Alternative 3 can result in great benefits; California's regulatory system will monitor and ensure that the standards are met for the restoration activities.

Constructing a large sill beneath the Highway 1 Bridge will be subject to the CEQA provisions, since it is a project that has a potential for resulting in physical change to the environment. The tidal barrier is a structure that may be subject to several discretionary approvals by governmental agencies. Proposing the construction of a sill under the Highway 1 bridge would require an EIR. This is a detailed report written by the lead agency describing and analyzing the significant environmental effects of the proposed restoration project activities. This document would also identify alternatives and help to determine which level and configuration of sills could reduce or avoid the possible environmental damage.

Alternative 3 would require the CDFG to ensure that interim and long-term restoration actions meet the state's endangered species compliance standards. CDFG issuance of a permit is contingent on prevention of harm to any endangered species (PWA 2006). Concerns noted previously by particular stakeholders about impacts to the threatened southern sea otter from implementation of Alternative 3 raise a possible scenario whereby project managers will need to work with CDFG. If the project is found to potentially harm an endangered or threatened species, then the project managers will request authorization through the form of an incidental take permit according to CESA Sections 2081 (b) and (c). Adequate mitigation measures must accompany the incidental take permit to minimize or avoid takes of the protected species.

Supplementing CESA, the CDFG list of Fully Protected Species and an informal list of Species of Special Concern add strengthened protection measures requiring that species cannot be harmed or possessed at any time. Species listed as threatened or endangered such as the Brown pelican and Southern sea otter require special consideration ensuring that no impacts occur to these species as a result of the tidal barrier. Species of Special Concern are broadly defined as wildlife species that are of concern to the CDFG because of population declines and restricted distributions. Elkhorn Slough and CDFG biologists shall determine whether any potential impacts will occur to any Species of Special Concern. CEQA regards impacts to these species as significant and requires special project mitigation measures or consideration of other alternatives. The tidal barrier project would likely require implementation of wildlife mitigation measures.

The tidal barrier would create an obstruction to the current natural flow and fall under Section 1602 of the California Fish and Game Code. This provision regulates all diversions, obstructions, or changes to the natural flow, or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources. The barrier may alter sections of the flow in the Elkhorn Slough that is in CDFG jurisdiction and therefore project managers will notify the agency. Since CDFG is charged with ensuring that interim and long-term restoration actions comply with the Fish and Game Code, Alternative 3 may also require a Section 1602 permit.

Projects that affect wetlands or waters must also meet waste discharge requirements of the RWQCB under California's Porter–Cologne Water Quality Control Act (California Public Resources Code § 13000 et seq). Any activity that results or may result in a discharge that directly or indirectly impacts waters of the State, or the beneficial uses of those waters, are subject to water discharge requirements. The water discharge requirements may be applied to the Elkhorn Slough restoration project under Alternative 3, depending on the ultimate project design and use of fill materials.

Finally, the state regulates coastal zone development activities and generally requires a coastal development permit from the CCC or in instances where local government has developed an approved LCP, from the local governing agency. The Elkhorn Slough restoration project alternatives that fall within the coastal zone are within the jurisdiction of the CCC. Therefore, a Coastal Development Permit would need to be issued for Alternative 3 following the Commission's review.

### 7.4.5 Federal Regulations

Alternative 3 will involve some federal involvement due to overlapping jurisdictions and permitting authority over certain resources. Local and state agencies would be involved in the majority of work required for Alternative 3, although certain activities will require federal regulation.

If any federal agencies are involved either in the funding or physical actions associated with Alternative 3 and the project is considered to have actions significantly affecting the quality of the environment, then the project will require NEPA documentation will be required. Alternative 3 may not require NEPA documentation unless the lead agency on the project is federal or primary funding comes from the Corps. According to the statutes, NEPA directs all federal

agencies to give appropriate consideration to the environmental effects of their decision making and to prepare detailed (EIS on recommendations or reports on proposals for legislation and other major federal actions significantly affecting the quality of the environment (Public Law 91-190). Even in the case of federal involvement, a joint federal and state planning document (EIR/EIS) would suffice, using CEQA as the primary tool.

Both NOAA Fisheries and the U.S Fish and Wildlife Service share responsibility for administration of the ESA (Public Law 93-205). As described under CESA, an incidental Take Authorization Permit is necessary if impacts may potentially affect Southern sea otters, Brown pelicans, or the Western snowy plover, all federally listed threatened species that inhabit the Slough. This permit would consist of a Biological Opinion and Incidental Take Statement which must establish that the proposed take would not jeopardize the continued existence of the endangered or threatened species.

Issuance of an Incidental Take Authorization may occur either under Section 10(a) of the ESA for projects that have no other federal involvement, or under Section 7 of the ESA for projects that require funding or permits from other federal agencies. Elkhorn Slough restoration Alternative 3 would likely require a CWA Section 404 permit from the Corps and also Section 7 consultation between the Corps and FWS and/or NOAA Fisheries for any identified federally listed endangered and threatened species.

Alternative 3 requires consultation under the Fish and Wildlife Co-ordination Act due to surface water modification provisions. The Act requires consultation with FWS, NOAA Fisheries, and CDFG before they undertake or approve projects that control or modify surface water (Public Law 85-624). The consultation is intended to prevent the loss of or damage to fish and wildlife in connection with water projects and to develop and improve these resources. The consultation can incorporate the information in the Section 404 permit for Alternative 3.

The Corps is responsible under Section 404 of the CWA for regulating discharges of fill or dredged material into U.S. waters (Public Law 93-205). In general, a nationwide or individual section 404 permit must be obtained for Alternative 3, which mandates permission before placing fill or dredging in designated wetlands or other waters. Nationwide permits are authorized for certain categories of projects that are deemed to have minimal impacts on aquatic resources. NEPA review is required for each nationwide permit, although once established, project specific NEPA compliance is not required for subsequent actions. The EPA and FWS are responsible for reviewing permit applications and making approval determinations. Dredging activities to install the tidal barrier will require a Section 404 permit. The type of permit required, nationwide or individual, depends on the amount of acreage involved and the end purpose of any proposed fill.

Section 401 of the CWA specifies that states must certify that any activity subject to a permit issued by a federal agency, such as the Corps, meets all state water quality standards (Public Law 93-205). The RWQCB is regionally responsible for taking certification actions for activities subject to any permit issued by the Corps pursuant to Section 404 (or for any other Corps permit, such as permits issued pursuant to Section 10 of the Rivers and Harbors Act of 1899). Actions may include issuance of a 401 certification noting that the activity subject to the federal permit

complies with state water quality standards, issuance of a conditional 401 certification, and denial of 401 certification. In instances where the 401 certification is denied, the associated federal permit is also deemed denied.

Alternative 3 would require water quality consultation with the RWQCB ensuring compliance with state standards. Other restoration wetland restoration projects on the Central Coast have been subject to stringent Section 401 requirements regarding surface water quality.

The MBNMS prohibits activities that dredge or deposit any part of the seabed within the Sanctuary (Title 15, CFR Section 922.132). The development of a tidal barrier will require dredging permits upon MBNMS review since the construction will occur adjacent to the Sanctuary.

ESNERR encompasses about 1400 acres on the south and east side of Elkhorn Slough under the jurisdiction of CDFG. One of the big threats to the Elkhorn Slough is the degraded Slough habitats. The Reserve facilitates and encourages research on many topics, one of large importance; restoration ecology of degraded Slough tidal habitats. A permit is required for any research done within Elkhorn Slough Reserve. This can include research for policy documents, which the permits only take a few days to receive authorization. Although in most other parts of the Slough (Elkhorn Slough Marine Park), CDFG issues Scientific Collecting permits and they are more difficult to obtain.

### 7.4.6 Regulatory, Institutional, and Finance Issues – Lessons Learned

The relevant case-studies present suggestions by project managers addressing particular regulatory, institutional, and financial setbacks applicable to Alternative 3. This section discusses those lessons learned that may help guide decisions throughout the process of designing and implementing a tidal barrier at Highway 1. These lessons learned from related estuary restoration projects help managers to strategize and prepare for policy-related issues that may arise if Alternative 3 is chosen.

Alternative 3 would incorporate input from various government agencies and consulting firms. The Bolsa Chica Lowlands restoration had an environmental review that required a multi-agency collaboration causing the process to progress more slowly, which may have been more efficient under a single agency lead. Another significant delay resulted from the decision to complete specific engineering analyses responding to concerns raised during the commenting period of the draft EIR/EIS. Although project activities experienced some delay, the highly detailed information presented in the documentation ensured that no legal challenges occurred under NEPA/CEQA. If environmental impacts are not accurately predicted and thoroughly documented, the restoration project faces further obstacles and potential rejection. For Alternative 3, investing in thorough engineering analyses for the tidal barrier will reduce the likelihood of legal challenges to the project (Fancher 2007).

Determining the course of action based on the desired outcomes is especially relevant to Alternative 3, as well as the other restoration options. The Napa-Sonoma restoration project faced debates over whether the restoration outcomes should support a pristine salt marsh

ecosystem or conditions more favorable to endangered species. This conflict created a major obstacle in terms of planning and environmental compliance because while reports and assessments were being developed managers remained undecided on the overall objectives. While Alternative 3 has one objective to reduce the tidal flow, different designs can affect the effectiveness of a particular outcome, which makes declaring success more difficult. The outcome of Alternative 3 should be defined specifically in order to reach the particular restoration goal. Otherwise managers should explore different restoration methods of obtaining the desired result.

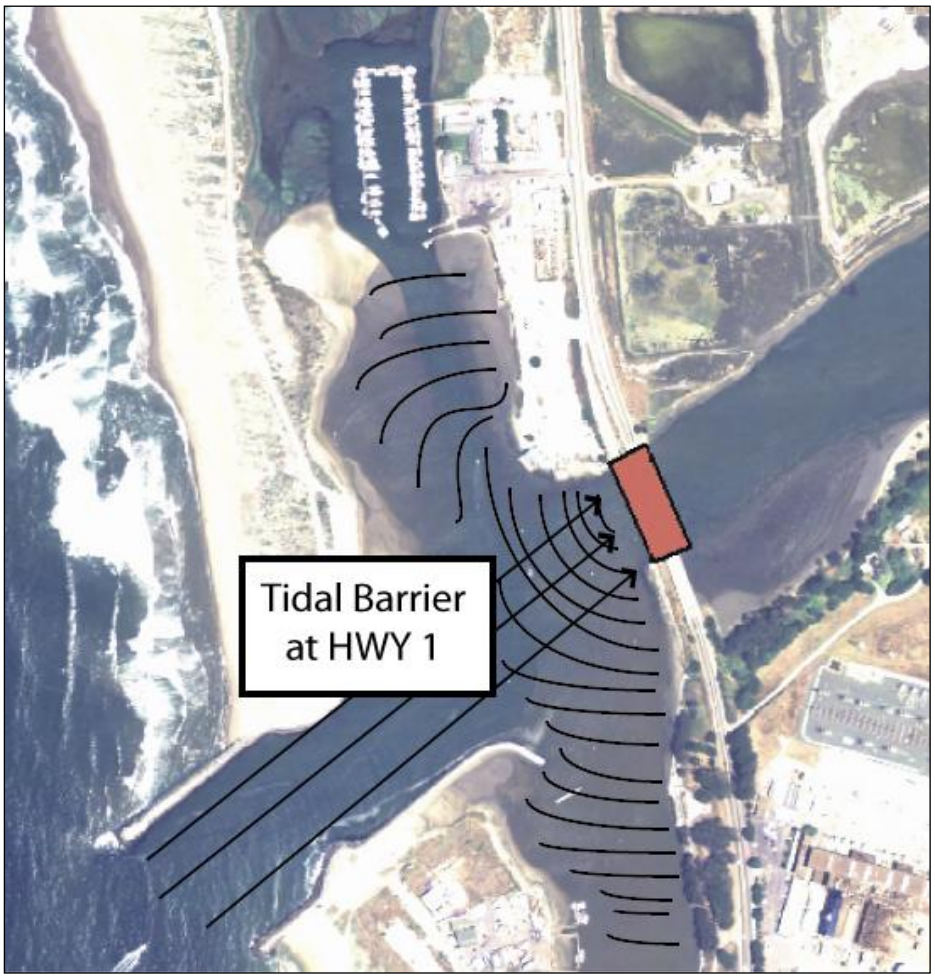
Certain expenditures exceeded the budget due to accommodating stakeholder input received late in the restoration process. Since Alternative 3 has already raised concerns about additional costs related to dredging and adjusting the harbor, the possibility exists that expenditures could increase following stakeholder input. At Morro Bay, accepting many suggestions led to expensive re-designing of project elements. Stakeholder input is critical prior to the final design work and should be considered for inclusion in the plans. Although the project lead at Morro Bay noted that there is a point when it becomes difficult and expensive to make even minor changes and this notion needs to be clear to participants and managed accordingly. Issues raised by stakeholders about Alternative 3 must be carefully evaluated so that the benefits of any sill design changes outweigh the costs and efforts.

### 7.4.7 Other Areas of Legal and Political Concern

This section outlines concerns presented by local stakeholders and jurisdictional entities throughout the decision making process for determining the alternatives. These concerns offer insights into potential legal and political barriers. Estuary managers should note that these issues are not comprehensive but display real problems and illustrate the types of issues to expect from interested parties under Alternative 3.

Businesses and local regulatory bodies who depend on the Moss Landing Harbor raise concerns about potential environmental impacts and associated policy issues. Developing a tidal barrier may have wildlife impacts on the sea otter and harbor seal. Since wildlife could be caught on either side of the sill, some worry that this could divide families of the mammal species. The designation of sea otters as a threatened species under the Federal Endangered Species Act and as a fully protected species under California State law may pose additional challenges to the construction of a sill in the event of harm to the species. Federal and state law would require the use of mitigation for Alternative 3 to reduce or avoid any impacts to these species.

Another potential harbor impact from Alternative 3 stems from wave refraction, a process where the barrier would not allow the force from the tide to dissipate up the main Elkhorn Slough channel (figure 39). The more forceful waters may rebound within the harbor causing more movement and potentially threatening the designation of Harbor of Safe Refuge. According to




*Source: PWA*

**Figure 39 Illustration of wave refraction concerns**

California's Harbors and Navigation Code section 70.3, a Harbor of Safe Refuge "means a port, harbor, inlet, or other body of water normally sheltered from heavy seas by land and in which a vessel can navigate and safely moor [make fast to the shore or to an anchor]." Section 70.5 specifically designates Moss Landing as a Harbor of Safe Refuge, whereby vessels have a safe place to wait out any dangerous sea conditions.

Impacts related to sediment build up on the tidal barrier present higher annual costs, lower depths, and may also impact the Safe Harbor designation. Greater frequency of dredging may occur on both sides of the tidal barrier. Ocean sediment can build up inside of the Moss Landing Harbor causing the harbor depth to decrease. The shallower water could potentially impact the travel of marine vessels. The Officer in Charge, for Marine Inspection of the U.S. Coast Guard determines the need for increased dredging due to sediment buildup in the Harbor of Safe Refuge (UCG).

Dredging costs pose a concern if the additional sediment build-up from the tidal barrier causes the MLHD to expend more funds. In this case, restoration managers would likely need to design

a financing mechanism to cover those costs, so as to avoid legal action for extra costs incurred by the restoration project. Therefore, budgeting for dredging and other anticipated costs is necessary (Kerry).

## *7.5 Alternative 4 – Reduce Parson's Slough Tidal Prism*

Alternative 4 is unique compared to the other proposed alternatives because no mechanisms change the ocean inlet or the Slough channel to alter the tidal prism. Alternative 4 reduces tidal scour and minimizes erosion rates below Parsons Slough by adding sediment in the upper region of Elkhorn Slough (PWA 2008). The restoration of Parson's Slough utilizes sediment fill, a water control structure at the mouth, or a combination of the two. Alternative 4 has been considered independently from the other proposed restoration alternatives, although Parson's Slough restoration is also an element of Alternatives 2 or 3.

This option presents a large-scale salt marsh restoration to Parson's Slough, which is currently a mudflat. Parson's contributes more to the tidal exchange, almost twice as much as the rest of the Slough. Elkhorn Slough managers attribute farming practices to the increased tidal exchange. The tidal prism is three times greater than measured 50 years ago. The tidal prism washes away soft muds that harbor essential pieces of the food web and adversely impact wildlife and vegetation. Reducing the tidal exchange will slow the export of sediment that negatively impacts the rest of the Slough. Restoring Parson's helps achieve overall restoration goals and thus, is why it is a component of the other restoration alternatives.

A consulting firm conducted an analysis of Parson's Slough restoration alternatives. Decision makers recommended Alternative 2 proposed in that report, which includes building a sill under the railroad bridge at the mouth of Parson's Slough and adding large amounts of sediment (Moffatt and Nichol 2008).

Funds for restoring Parson's Slough were sought and obtained through a NOAA stimulus grant. Starting date for the restoration is in 2010 and completion should occur 18 months later if all goes according to plan.

### 7.5.1 Policy Implications

Alternative 4 presents a restoration alternative that has lower sociopolitical and economic impacts considering that the project would occur further up in the Slough, away from the Highway, Harbor, and other major public uses. The Union Pacific Railroad company is one of the primary stakeholders for Alternative 4, due to the construction of a tidal barrier under the railway. Project managers for this option confirmed that talks with the Union Pacific Railroad Co. were successful. Another restoration project that project that will scheduled to begin in Fall 2008, is the North Azevedo Pond. This project is adjacent to the railway and was successful in gaining permissions from Union Pacific. This proves that even though the railroad is an affected party of Elkhorn Slough restoration, they are willing to move forward. In fact project managers noted that train track stability actually increases, improving the railway.

Parson's Slough also includes private landholders along the edges of the inner Slough. Private landholders adjacent to the Slough are concern about seawater intrusion contaminating the

groundwater and thus support restoration efforts. The lower rates of tidal exchange cause less potential for seawater infiltration into aquifers.

### 7.5.2 Regulatory, Institutional, and Finance Issues – Lessons Learned

The Parsons Slough project now has been funded as part of the federal government's stimulus package from NOAA, and will go forward during the period 2009-2011. Installation of a depressed, underwater sill will require far fewer permits and agency participants. The agencies and permits listed below are those most involved in this restoration (table 26). Because it has been funded by NOAA, is away from the navigable waters of the harbor, and will not involve Highway 1 in any way, the primary agencies will be those that are involved with the NERRS – NOAA and CDFG, the state and federal EPAs, the CCC, and the local and state Water Resources Control Boards, Monterey County, and MLHD. Other agencies will have peripheral engagement. This option is by far the least onerous and difficult of all of the options mentioned above except for "no action."

### 7.5.3 Required Permissions

**Table 26 Applicable regulations for Alternative 4**

| Regulations/Authorities | Permissions Required | Consultation Required |
|---|---|---|
| Federal Endangered Species Act | √ | √ |
| Clean Water Act Section 404 | √ | |
| Clean Water Act Section 401 | | √ |
| National Environmental Policy Act | √ | √ |
| Fish and Wildlife Co-ordination Act | | √ |
| National Marine Sanctuary | | √ |
| ESNERR | √ | √ |
| California Endangered Species Act | √ | |
| California Environmental Quality Act | √ | √ |
| CDFG Section 1602 | | √ |
| Porter-Cologne Water Quality Control Act | | √ |
| California Coastal Act | √ | √ |
| Moss Landing Harbor District Ordinance Code | √ | |
| Union Pacific Railroad Co. | √ | √ |
| County Zoning and Ordinances | √ | |

## *7.6 Conclusions*

However, there is another entire set of options not considered that may end up as the most reasonable strategy to follow: incremental projects over time, with limited objectives for resolving the erosion problem without causing additional problems. The first of these will be implemented soon with the construction of a flexible sill for the Parsons Slough area. As this project has progressed, and the PWA options discussed more fully, despite the fact that the PWA report is only a rudimentary, general analysis of the options, it has become clear that taking on the large-scale alternative is probably not the best strategy. The anticipated hurdles are so large, the time frame so long to get it underway, and the amount of funding possibly difficult to justify make this option one that would possibly do more damage than good, since the problem would

continue while the permitting process and political negotiations went forward and nothing would be done constructively for some time to deal with the problem at hand.

Most members of the EBM team agree that there are small steps that could be taken to stabilize and return some of the salt marsh in sections of the Slough without affecting other parts negatively. Funding for small projects would be easier than for the large options and work would probably get underway much sooner, with a healthy learning curve of what works and does not. A concise schematic follows illustrating policy requirements for each alternative (figure 40).

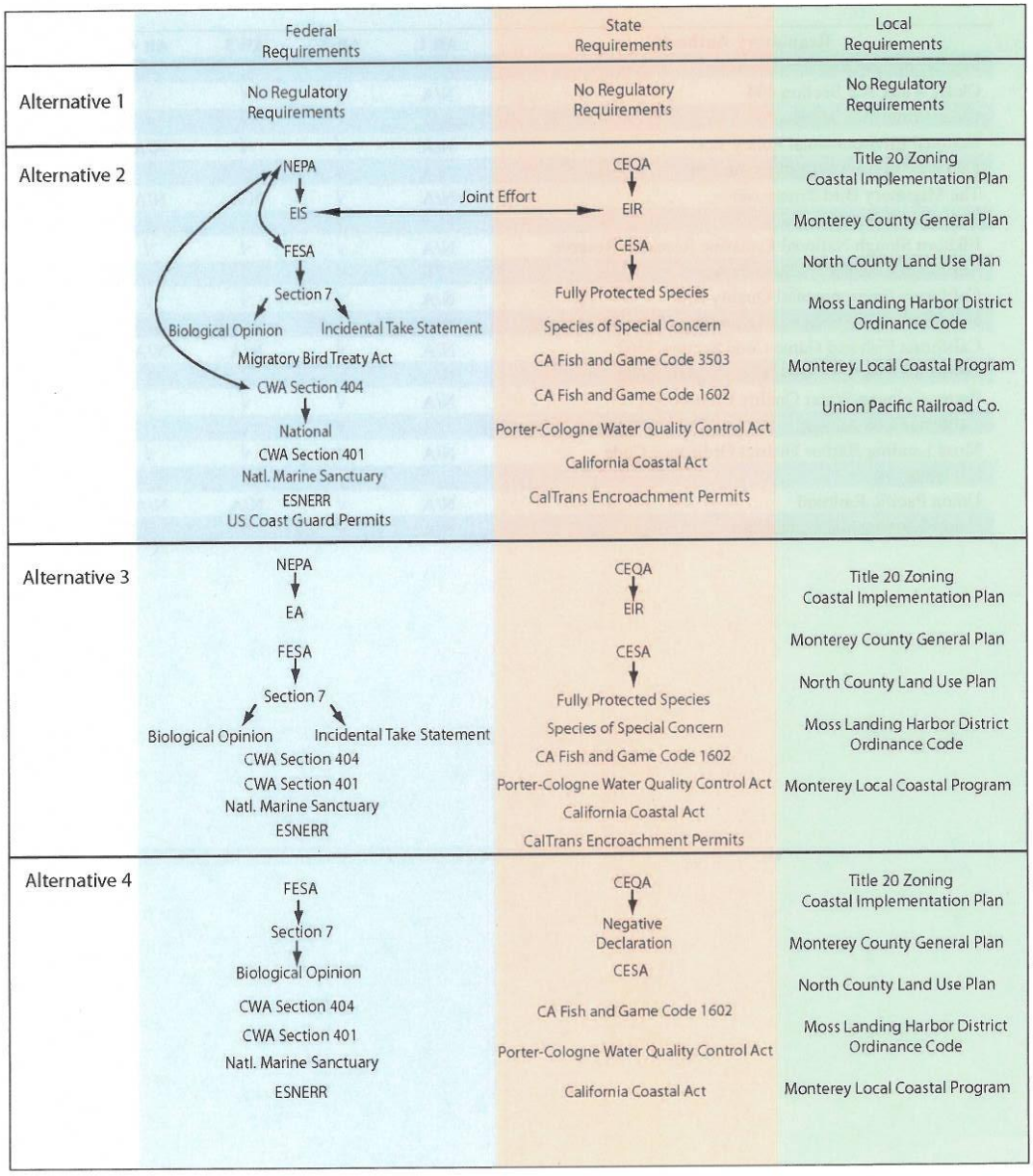



**Figure 40 Schematic of policy requirements for each alternative**

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# 9 Acronyms

BCDC……San Francisco Bay Conservation and Development Commission
CalEPA…….. California Environmental Protection Agency
Caltrans……. California Department of Transportation
CCC……California Coastal Commission
CDFG……. California Department of Fish and Game
CDPR……. California Department of Parks and Recreation
CEQA…… California Environmental Quality Act
CESA……..…… California Endangered Species Act
Corps…..…… U.S. Army Corps of Engineers
CPFV……..……Commercial passenger fishing vessels
CWA……..… Clean Water Act
EBM……..…… Ecosystem-Based Management
EIR……. Environmental Impact Report (State)
EIS……. Environmental Impact Statement (Federal)
EPA…… Environmental Protection Agency
ESA…… Endangered Species Act (Federal)
ESNERR…… Elkhorn Slough National Estuary Research Reserve
FEMA……Federal Emergency Management Agency
FWS U.S. Fish and Wildlife Service
LCP…… Local Coastal Plan
MBNMS…… Monterey Bay National Marine Sanctuary
MLHD…….…….. Moss Landing Harbor District
MSU……..…… Michigan State University
NEPA……..…… National Environmental Policy Act
NOAA…… National Oceanic and Atmospheric Administration
NOEP……..…… National Ocean Economics Program
NRCS……. Natural Resources Conservation Service (U.S. Department of Agriculture)
OCRM…… Office of Ocean and Coastal Resource Management
PWA…….. Phillip Williams and Associates
RWQCB…… Central Coast Regional Water Quality Control Board

# 10 Appendices

## 10.1 Appendix A: Coastal User Survey

**Elkhorn Slough Coastal User Survey**

**Survey Methods**

**Introduction**

**Scheduling**

Our scheduling protocol involved choosing the days, times of day, and locations for administering the survey. The interns surveyed two weekdays and one weekend day per week, which were selected using the random number generator in Excel. To determine location, we divided up the Slough/Moss Landing area into eight specific sites and one "other" site. Surveying location was chosen randomly between these sites also using the random number generator:

1. Visitor Center
2. Kirby Park
3. North Harbor boat launch
4. Kayak Connection dock (North Harbor)
5. Elkhorn Slough Safari (South Harbor)
6. South Jetty
7. Jetty Road parking lot
8. North Jetty
9. "Other" sites included any additional accessible destination in the Slough or Moss Landing, including Salinas River State Beach, the bridge area of Jetty Road, the docks near the Sea Harvest restaurant parking lot, etc.

The time of day during which the interns administered the survey was also randomized. We divided up the day into three two hour shifts: 9-11am, 12-2pm, and 3-5pm. If the interns were unable to survey at the randomly chosen day or time, a specific protocol was followed for choosing an alternative day and/or time. If the interns could not survey on a given weekday, they surveyed the following weekday. If they were already scheduled to survey on the next weekday, they surveyed the weekday after that. If the day they could not survey was a Friday, they either went the previous or following Monday. The following table shows our survey locations, days, and times:

| Date | Shift | Location |
|---|---|---|
| 6/27/2008 | 1 | 6 |
| 6/27/2008 | 3 | 6 |
| 6/28/2008 | 2 | 3 |
| 6/28/2008 | 3 | 7 |
| 7/1/2008 | 2 | 9 |
| 7/1/2008 | 3 | 4 |
| 7/3/2008 | 1 | 7 |
| 7/3/2008 | 1, 10-11am | 2 |

| Date | Shift | Location |
|---|---|---|
| 7/3/2008 | 3 | 3 |
| 7/6/2008 | 1, 9:30 -11am | 8 |
| 7/6/2008 | 2 | 2 |
| 7/8/2008 | 2 | 2 |
| 7/8/2008 | 3 | 3 |
| 7/11/2008 | 1, 9-9:45 | 3 |
| 7/11/2008 | 1, 9:45-11 | 4 |
| 7/11/2008 | 2 | 9 |
| 7/12/2008 | 2 | 6 |
| 7/12/2008 | 3 | 6 |
| 7/14/2008 | 1, 9-10AM | 9, S. Salinas River Beach |
| 7/14/2008 | 1, 10-11AM | 9, N. Salinas River Beach |
| 7/14/2008 | 2 | 3 |
| 7/16/2008 | 1 | 1 |
| 7/16/2008 | 3 | 1 |
| 7/19/2008 | 1 | 1 |
| 7/19/2008 | 2 | 1 |
| 7/21/2008 | 1 | 6 |
| 7/21/2008 | 2 | 9 |
| 7/22/2008 | 1 | 3 |
| 7/22/2008 | 3 | 2 |
| 7/26/2008 | 1 | 1 |
| 7/26/2008 | 3 | 1 |
| 7/27/2008 | 1 | 4 |
| 7/27/2008 | 2 | 6 |
| 7/29/2008 | 2 | 7 |
| 7/29/2008 | 3 | 7 |
| 7/30/2008 | 1 | 1 |
| 7/30/2008 | 2 | 3 |
| 8/4/2008 | 1 | 2 |
| 8/4/2008 | 2 | 7 |
| 8/6/2008 | 1 | 7 |
| 8/6/2008 | 2 | 9 |
| 8/9/2008 | 1 | 4 |
| 8/9/2008 | 2 | 8 |
| 8/13/2008 | 1 | 2 |
| 8/13/2008 | 2 | 9 |
| 8/15/2008 | 2 | 1 |
| 8/15/2008 | 3 | 3 |
| 8/17/2008 | 1 | 7 |
| 8/17/2008 | 2 | 1 |
| 8/18/2008 | 2 | 9 |
| 8/18/2008 | 3 | 9 |
| 8/21/2008 | 1 | 9 |
| 8/21/2008 | 2 | 1 |
| 8/24/2008 | 2 | 2 |
| 8/24/2008 | 3 | 9 |

| Date | Shift | Location |
|---|---|---|
| 8/25/2008 | 1 | 6 |
| 8/25/2008 | 2 | 6 |
| 8/27/2008 | 1 | 2 |
| 8/27/2008 | 2 | 7 |
| 8/27/2008 | 2 | 7 |
| 8/31/2008 | 1 | 9 |
| 8/31/2008 | 2 | 2 |

**Survey administration**

The survey was designed to be an intercept survey. Interns approached people and asked them if they would take a survey on their recreational use of the Slough and Moss Landing. If they agreed, they would hand them the survey to complete on their own. If they did not want to take the survey, the interns offered to conduct the survey as an interview.

We made small changes to our survey throughout the summer based on feedback from both the interns and respondents. Changes included modifying ambiguous questions and adding additional response choices as suggested by respondents and the interns. The following is the final version of survey:

Version 4; Official use only:
Respondent ID#_____ Date Time Location _____

COASTAL OCEAN VALUES CENTER

# Elkhorn Slough and Moss Landing Visitors, We Need Your Help!

Elkhorn Slough National Estuarine Research Reserve

Your visit to Elkhorn Slough helps support the working waterfront of one of California's rare estuaries. The Ocean Foundation, the Elkhorn Slough Foundation, and the Elkhorn Slough National Estuarine Research Reserve (ESNERR) are conducting a survey of coastal visitors in Elkhorn Slough to learn more about what you do when you visit here. We want to learn more about your attitudes, perceptions and the contribution you make to the local economy. Please take a few minutes to complete our survey.

A summary of the results of this survey will be published in a publicly available format available for download from the ESNERR website at the end of the one year study.

*All responses are confidential and you will not receive any mailings as a result of completing this survey. Your participation is voluntary. Thank you very much for your participation and support!*

**1) Have you been to the Elkhorn Slough waterfront (the estuary or Moss Landing harbor) before?**

- ☐ YES If so, how many times including this trip? _____ How many times in the last 12 months? _____
  If >50, do you visit: ☐ daily ☐ weekly ☐ monthly If >50, do you visit: ☐ daily ☐ weekly ☐ monthly
- ☐ NO

**2.1) How much have you spent or do you expect to spend during your current visit to the Slough on:**

Local accommodations (all nights) $_____ Kayak rentals $_____ Other $ _____
Meals (all meals) $_____ Bait or tackle $_____

**2.2) Were these expenditures for a group?**

- ☐ YES If so, how many people are in your group? _____
- ☐ NO

**3) How many days do you expect to spend in Elkhorn Slough during your current visit ____**

**4) How important was the quality of the Slough's aquatic ecosystem in your choice to visit the Slough?**

☐ Very important ☐ Important ☐ Not important

**5) For each of the following factors, how do you feel Elkhorn Slough compares to other areas on the California Coast:**

**Water pollution (for instance, bacteria, nutrients, or chemical pollutants):**

- ☐ Better than other coastal areas in California
- ☐ About the same as other coastal areas in California
- ☐ Worse than other coastal areas in California
- ☐ Not sure
- ☐ Never been to other areas on the California Coast

**Wildlife abundance (for instance otters, birds, and fish):**

- ☐ Better than other coastal areas in California
- ☐ About the same as other coastal areas in California
- ☐ Worse than other coastal areas in California
- ☐ Not sure
- ☐ Never been to other areas on the California Coast

**Overall ecosystem health:**

- ☐ Better than other coastal areas in California
- ☐ About the same as other coastal areas in California
- ☐ Worse than other coastal areas in California
- ☐ Not sure
- ☐ Never been to other areas on the California Coast

**6) Which of the following reasons were important in your decision to visit Elkhorn Slough (check all that apply)?**

| | | |
|---|---|---|
| ☐ Fishing in the slough | ☐ Bird watching | ☐ Wildlife viewing |
| ☐ Fishing in the ocean | ☐ Kayaking (incl. all paddle sports) | ☐ Boating |
| ☐ Surfing | ☐ Beach going | ☐ Hiking or walking |
| ☐ Shopping | ☐ Looking at fishing boats | ☐ Other: _____ |

**7) Please refer to the list of numbered sites on the next page and the corresponding map. For each numbered location, mark those activities you took part in or plan to take part in during your CURRENT visit. If you visited the**

site but did not participate in any of the activities listed, please check "Other". If you did not visit the site (or do not plan to), please indicate this. **

**1. Bennett Slough**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**2. Moss Landing North**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**3. Moss Landing South**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**4. Moro Cojo Slough**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**5. CDFG Wildlife Area**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

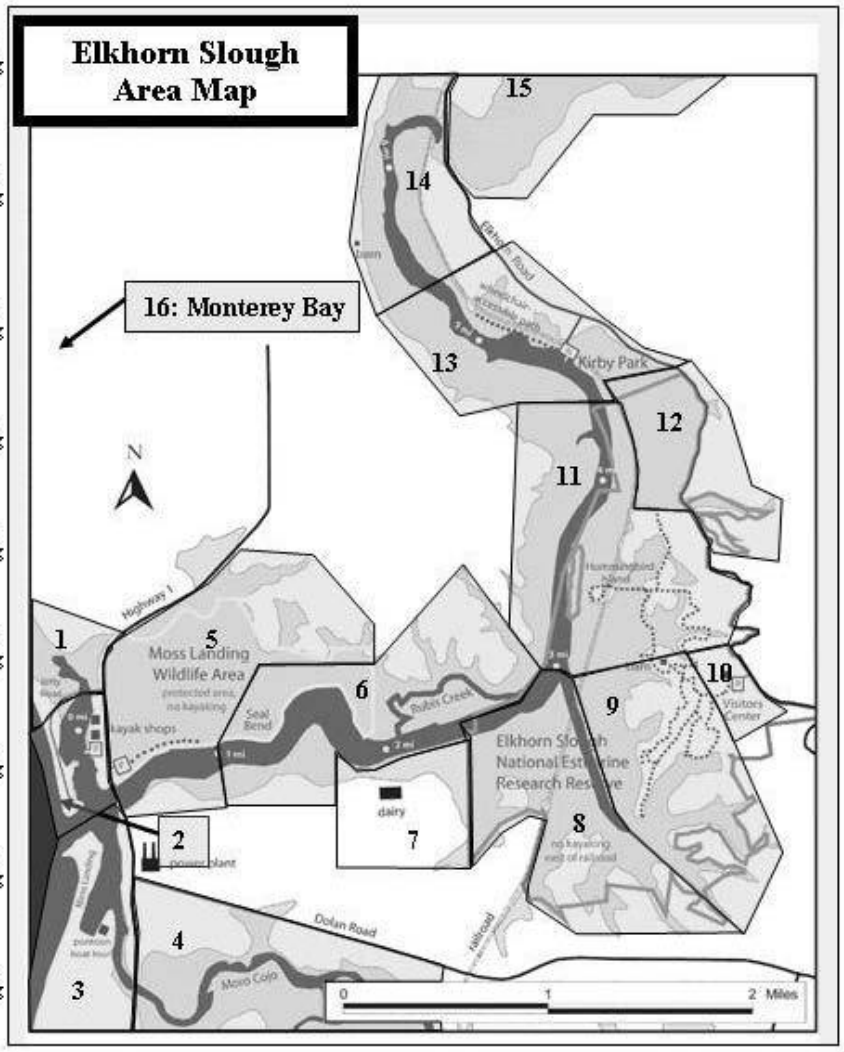
**6. Seal Bend/Rubis Creek**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**7. Moon Glow Dairy**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**8. ESNERR South**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**9. South Marsh**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**10. Visitors Center**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit




**Numbered regions in the map are based on ecological criteria rather than land ownership. Property boundaries for the named areas may not be geographically accurate. This map is for display purposes only and does not reflect local use regulations in any way.

**11. ESNERR North**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**12. North Marsh**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**13. Kirby Park**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**14. Hudson's Landing**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**15. Porter Marsh**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**16. Monterey Bay**
☐ Hiking/Walking ☐ Wildlife Viewing
☐ Fishing ☐ Birding ☐ Kayaking
☐ Other _____ ☐ Did not Visit

**8) IF YOU FISH in or near the Slough, please answer all parts of question 8:** 

**8.1) Please indicate what species of fish you hope to catch generally when you fish here(check all that apply):**

| | | |
|---|---|---|
| □ Surfperch | □ Halibut | □ Rays |
| □ Sole (English, Dover, Sand, etc…) | □ Sanddab | □ Shellfish |
| □ Salmon | □ Sharks (Leopard, Smoothhound, etc.) | □ Cabezon |
| □ Rockfish | □ Smelt | □ Other: _____ |
| □ Flounder | □ Pacific Staghorn Sculpin | □ Other: _____ |

**8.2) Mark the areas you generally fished during PREVIOUS visits to the Slough (refer to map on previous page):**

| | | | | |
|---|---|---|---|---|
| □ 1 | □ 5 | □ 9 | □ 13 | □ This is my first visit |
| □ 2 | □ 6 | □ 10 | □ 14 | |
| □ 3 | □ 7 | □ 11 | □ 15 | |
| □ 4 | □ 8 | □ 12 | □ 16 | |

**8.3) Do you generally eat or plan to eat your catch?** □ YES □ NO?

**8.4) ANGLERS, if you have fished the Slough for at least 5 years, do you feel that fishing in the Slough over the last 5 years has … (check one):**

□ Improved □ Remained the same □ Worsened □ Not sure □ I have been fishing the Slough for less than 5 years

**9) IF YOU LIKE TO BIRD WATCH in the Slough, please answer all parts of question 9:** 

**9.1) Please indicate which bird species you hope to see when you visit the area (check all that apply):**

| | | | |
|---|---|---|---|
| □ Shorebirds | □ Gulls & Terns | □ Herons and Egrets | □ Other: _____ |
| □ Songbirds | □ Raptors | □ Shearwater, Alcids, or other pelagic species | |
| □ Snowy Plovers | □ Ducks & Geese | □ No particular species, just birds in general | |

**9.2) BIRDERS, how many species of birds do you estimate you observed during this visit? _____**

**9.3) BIRDERS, of the following which is the most important for choosing to visit the Slough (check one):**

□ Bird diversity □ Bird abundance □ Seeing rare birds

**9.4) BIRDERS, would you visit the Slough more often if there were more shorebirds?** □ YES □ NO

**9.5) BIRDERS, in which of the following habitat types do you prefer to see birds (check all that apply)?**

| | | |
|---|---|---|
| □ Beach | □ Salt Marsh | □ Eucalyptus/Pine Groves |
| □ Open Water | □ Scrub/Chaparral | □ Agricultural Land |
| □ Mudflats | □ Oak Woodland | □ Other: _____ |

**9.6) BIRDERS, if you have visited the Slough for at least 5 years, do you feel that birding in the Slough over the last 5 years has… (check one):**

□ Improved □ Remained the same □ Worsened □ Not sure □ I have been birding the Slough for less than 5 years

**10) IF YOU LIKE TO WATCH OTHER WILDLIFE, please answer all parts of question 10:** 

**10.1) Please indicate which species you hope to see when you visit the area (check all that apply):**

| | | | |
|---|---|---|---|
| □ Otters | □ Leopard Sharks | □ Whales | □ Other: _____ |
| □ Sea Lions | □ Crabs | □ Salamanders | □ Other: _____ |
| □ Harbor Seals | □ Dolphins | □ Frogs | |

**10.2) In which of the following habitat types do you prefer to watch other wildlife (check all that apply)?**

| | | |
|---|---|---|
| □ Beach | □ Salt Marsh | □ Eucalyptus/Pine Groves |
| □ Open Water | □ Scrub/Chaparral | □ Agricultural Land |
| □ Mudflats | □ Oak Woodland | □ Other: _____ |

**10.3) If you have been visiting the Slough for at least 5 years, do you feel that wildlife watching in the Slough over the last 5 years has… (check one):**

□ Improved □ Remained the same □ Worsened □ Not sure □ I have been visiting the Slough for less than 5 years

**11) IF YOU LIKE TO KAYAK, please answer all parts of question 11:** 

**11.1) Please indicate if you have ever launched your kayak at (check all that apply):**

□ Kirby Park □ Moss Landing Harbor □ Other: _____

**11.2) KAYAKERS, indicate whether you engage in any of the following activities while kayaking (check all that apply):**

□ Guided Wildlife Tour □ Kayaking Lesson □ Calm Reflection/Relaxation
□ Non-guided Wildlife Viewing □ Physical Exercise □ Photography
□ Bird-Watching □ Fishing □ Other: _____

**11.3) KAYAKERS, which of the following habitat types do you like to kayak in or near (check all that apply)?**

□ Open Ocean □ Salt Marsh □ Tidal Creeks
□ Slough Open Water □ Mudflats □ Agricultural Land
□ Oak Woodland □ Chaparral/Scrub □ Other: _____

**11.4) KAYAKERS, please indicate whether you rented a kayak or brought your own equipment from home:**

□ I rented a kayak □ I used my own kayak □ Other _____

**11.5) KAYAKERS, if you have been visiting the Slough for at least 5 years, do you feel that kayaking in the Slough over the last 5 years has … (check one):**

□ Improved □ Remained the same □ Worsened □ Not sure □ I have been kayaking the Slough for less than 5 years

**12) EVERYONE, would you visit the Slough more often if there were more of the following (check all that apply)?**

□ Access Points □ Hotels □ Mudflats □ Other _____
□ Saltwater Marsh □ Shops/ Restaurants □ Open Water Areas

**13)If the following changes were to take place would you visit the Elkhorn Slough/Moss Landing area more often, less often, or the same?**

| | Visit more often | Visit less often | Same/No change |
|---|---|---|---|
| **Increase in Saltwater Marsh** | □ | □ | □ |
| **Decrease in Saltwater Marsh** | □ | □ | □ |
| **Increase in Mudflat** | □ | □ | □ |
| **Decrease in Mudflat** | □ | □ | □ |
| **Increase in Open Water areas** | □ | □ | □ |
| **Decrease in Open Water areas** | □ | □ | □ |
| **Increase in Otters** | □ | □ | □ |
| **Decrease in Otters** | □ | □ | □ |

**Questions 14-21 are used to help extrapolate your answers to the general public; all answers will remain confidential.**

**14) Do you ever visit the Slough or Moss Landing with children? (please circle) Often Sometimes Never**
**15) What is your zip code of residence?** _____
**16) Do you work in Elkhorn or Moss Landing?** □ YES □ NO
**17) Are you:** □ MALE □ FEMALE
**18) What is your age?** _____ **years old**
**19) How would you describe your race/ethnicity (check all that apply)?**

□ White □ Black or African American □ Hispanic
□ American Indian or Alaskan Native □ Native Hawaiian or Pacific Islander □ Spanish □ Latino
□ Asian □ other _____

**20) What is your estimated HOUSEHOLD income?**

□ less than $30,000 □ $90,000 – $120,000 □ $180,000 – $210,000
□ $30,000 – $60,000 □ $120,000 – $150,000 □ greater than $210,000
□ $60,000 – $90,000 □ $150,000 – $180,000

**21) Survey administered to participant primarily in**

□ English □ Spanish

**Thank you very much for participating in the survey! Please feel free to add comments below!**

**The Elkhorn Slough Foundation has generously donated a $100.00 Gift Certificate for the ESNERR Bookstore, to be given away to one winner at the end of this study. If you would like to be eligible for the drawing please list your name, mailing address, and telephone number on the attached comments section. We will contact you only if you are selected as a winner and will not release your contact information to anyone for any reason.**

**Comments:**

## Data entry

We used Survey Monkey as a tool for entering survey data rather than as the survey tool itself. After the interns surveyed in the field, they transcribed the answers from the paper surveys into an identical survey set up on Survey Monkey. Once the interns entered all of the survey data, we downloaded the data into Excel spreadsheets. Using Survey Monkey made data entry more efficient and allowed us to easily generate summary statistics.

In addition to surveying visitors, the interns collected a variety of other data while out in the Slough, including:

- The number of users in their survey location
- The type of activity that visitors were engaged in when they counted them
- Whether the visitors were children or adults
- The number of surveys completed and refused
- General notes about the day: weather, how busy the location was, etc.
- Questions and comments from respondents
- Survey questions that respondents had particular difficulty with

These observations provide qualitative information that can give further depth to our survey results. Not only can we analyze the survey questions for our respondent pool as a whole, but we can also analyze our data based on where the respondent was surveyed. Also, since the interns were only able to interview one person at a time, having basic data on what activities people were engaged in at a given site gives us an overview about where people engage in certain activities, even if we are not able to survey them.

## Basic Analysis of Data

The survey period was from June 27th through August 31st, 2008 (see Table X). During this period, the ESNERR interns were able to administer 308 surveys at all locations except for the Elkhorn Slough Safari site; the owner was not comfortable with us administering surveys to his customers. We were able to collect the most responses at the "other" locations (location 9), South Jetty (location 6), and the ESNERR Visitor Center (location 1) (Table X). Surveys collected at these three locations comprised over 55 percent of the total responses.

| Location | # of Surveys Completed | Percent of Total |
|---|---|---|
| 1 | 48 | 15.79% |
| 2 | 46 | 15.13% |
| 3 | 36 | 11.84% |
| 4 | 10 | 3.29% |
| 5 | never visited | n/a |
| 6 | 50 | 16.45% |
| 7 | 32 | 10.53% |
| 8 | 10 | 3.29% |
| 9 | 72 | 23.68% |
| **TOTAL** | **304** | |

More tables are provided in the appendix.

**Future research**

In addition to the basic analyses we presented above, there are other interesting questions that can be answered by our survey that would provide valuable information for restoration planning. For example, it would be useful to look at per person or per trip expenditures compared with respondents' answer to question 4 ("How important was the quality of the Slough's aquatic ecosystem in your choice to visit the Slough?"). Are people who are concerned about the Slough's water quality and water habitats spending more than those for whom this issue is not important? The results of this analysis could suggest the future value of an improved aquatic ecosystem.

It would also be helpful in the future to devise a simple way to determine how site specific people are. We would not need to change the survey to answer this question; we know where visitors go based on their responses to the map questions. The data entry format as it is now, however, needs to be changed to make this calculation more straight forward.

The information gathered from our summer 2008 survey provides a baseline of nature tourism and recreation in Elkhorn Slough and Moss Landing. While this gives us a snapshot of recreation in the Slough, future iterations of this survey will begin to map out how visitation and recreation is changing over time in the area. It will be especially important to continue administering this survey as restoration activities begin, during restoration, and after to determine the effects of restoration on coastal recreation and the Elkhorn Slough economy. Also, we administered the survey during the summer months only. It will be important to collect data year round so that seasonal variations in recreation and visitation are reflected in the data.

## 10.2 Appendix B: Coastal User Survey Analysis

This section includes the complete results from our analysis of the Elkhorn Slough Coastal User Survey data. Analyses were conducted using STATA.

| | Median | Mean |
|---|---|---|
| **All** | 1 | 1.56 |
| **Fish** | 1 | 1.58 |
| **Birding** | 1 | 1.58 |
| **Wildlife Viewing** | 1 | 1.57 |
| **Kayaking** | 1 | 1.65 |

Table 1. Mean and median trip length (days) of Elkhorn Slough visitors who engaged in these four activities during their visit.

| | Mean | Median |
|---|---|---|
| **Birding** | 21.03 | 8 |
| **Wildlife** | 19.28 | 6 |
| **All** | 19.00 | 6 |
| **Fishing** | 18.47 | 6 |
| **Kayaking** | 18.25 | 6 |

Table 2. Mean and median frequency of visitation in the last 12 months of Elkhorn Slough recreational users who engaged in these four activities during their current visit.

| | Mean | Median | Mean* | Median* |
|---|---|---|---|---|
| **Kayaking** | $135.96 | $32.00 | $193.10 | $85.00 |
| **Birding** | $110.96 | $20.00 | $194.18 | $60.00 |
| **Wildlife Viewing** | $122.67 | $20.00 | $205.71 | $60.00 |
| **All** | $119.27 | $18.00 | $202.96 | $60.00 |
| **Fishing** | $66.56 | $12.00 | $123.62 | $50.00 |

*** Zero Truncated Statistic (There are 127 zero responses)**

Table 3. Mean and median expenditures per trip of visitors who engaged in these four activities during their visit to the Slough.

| | Responses | Median | Mean | Median* | Mean* |
|---|---|---|---|---|---|
| **Shopping** | $14.00 | $90.00 | $184.64 | $250.00 | $287.22 |
| **Kayaking** | $79.00 | $60.00 | $187.35 | $100.00 | $242.64 |
| **Beach Going** | $82.00 | $30.00 | $79.63 | $52.50 | $116.61 |
| **Wildlife Viewing** | $175.00 | $22.00 | $146.52 | $60.00 | $239.63 |
| **Birding** | $125.00 | $20.00 | $146.10 | $62.00 | $250.17 |
| **Other** | $57.00 | $20.00 | $103.82 | $60.00 | $169.07 |

| | | | | | |
|---|---|---|---|---|---|
| **Fishing in Slough** | $28.00 | $17.50 | $55.32 | $45.00 | $96.81 |
| **Boating** | $16.00 | $17.50 | $98.56 | $70.00 | $175.22 |
| **Hiking** | $130.00 | $15.00 | $127.90 | $60.00 | $215.94 |
| **Looking at Fish Boats** | $22.00 | $15.00 | $111.68 | $40.00 | $153.56 |
| **Surfing** | $19.00 | $2.00 | $69.95 | $17.50 | $132.90 |
| **Fishing in Ocean** | $23.00 | $0.00 | $35.39 | $45.00 | $81.40 |

*** Zero Truncated Statistic**

Table 4. Mean and median visitor expenditures sorted by their stated reasons for visiting Elkhorn Slough. Respondents were able to choose as many reasons for visiting that applied.

| | All | Fishing in Slough | Birdwatching | Wildlife Viewing | Fishing in Ocean | Boating | Kayaking | Surfing | Beachgoing | Hiking | Shopping | Looking at Fishing Boats | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | | | | | | | | | | | | | |
| **Median** | 49 | 38 | 50 | 50 | 36 | 52 | 50 | 42 | 46 | 50 | 54 | 49 | 50 |
| **Mean** | 47.99 | 40.31 | 50.98 | 49.56 | 40.05 | 50.38 | 47.82 | 39.00 | 46.54 | 51.03 | 54.29 | 47.00 | 48.44 |
| **Income** | | | | | | | | | | | | | |
| **% < $60k** | 99.00 | 0.08 | 0.40 | 0.61 | 0.07 | 0.03 | 0.25 | 0.08 | 0.33 | 0.40 | 0.00 | 0.09 | 0.15 |
| **% < $150K** | 126.00 | 0.10 | 0.40 | 0.56 | 0.10 | 0.09 | 0.28 | 0.05 | 0.27 | 0.45 | 0.08 | 0.10 | 0.20 |
| **% > $150K** | 40.00 | 0.03 | 0.45 | 0.63 | 0.03 | 0.03 | 0.20 | 0.03 | 0.15 | 0.50 | 0.05 | 0.00 | 0.23 |
| **Race** | | | | | | | | | | | | | |
| **Num White** | 221 | 8 | 103 | 135 | 9 | 11 | 68 | 16 | 54 | 94 | 12 | 13 | 41 |
| **% White** | 1.00 | 0.04 | 0.47 | 0.61 | 0.04 | 0.05 | 0.31 | 0.07 | 0.24 | 0.43 | 0.05 | 0.06 | 0.19 |
| **Num Black** | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| **%Black** | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Num Asian** | 13 | 3 | 3 | 5 | 1 | 1 | 5 | 0 | 4 | 3 | 0 | 1 | 3 |
| **%Asian** | 1.00 | 0.23 | 0.23 | 0.38 | 0.08 | 0.08 | 0.38 | 0.00 | 0.31 | 0.23 | 0.00 | 0.08 | 0.23 |
| **Num AINA*** | 5 | 0 | 3 | 2 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 3 |
| **%AINA*** | 1.00 | 0.00 | 0.60 | 0.40 | 0.00 | 0.00 | 0.20 | 0.00 | 0.20 | 0.60 | 0.00 | 0.00 | 0.60 |
| **Num NHPI**** | 4 | 2 | 1 | 2 | 1 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 0 |
| **%NHPI**** | 1.00 | 0.50 | 0.25 | 0.50 | 0.25 | 0.25 | 0.25 | 0.00 | 0.25 | 0.50 | 0.00 | 0.00 | 0.00 |
| **Num Hispanic** | 40 | 10 | 7 | 15 | 8 | 2 | 4 | 2 | 14 | 17 | 1 | 3 | 6 |
| **% Hispanic** | 1.00 | 0.25 | 0.18 | 0.38 | 0.20 | 0.05 | 0.10 | 0.05 | 0.35 | 0.43 | 0.03 | 0.08 | 0.15 |
| **Num Spanish** | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 |
| **%Spanish** | 1.00 | 0.50 | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.50 | 0.00 |
| **Num Latino** | 8 | 5 | 1 | 4 | 3 | 1 | 0 | 0 | 3 | 4 | 0 | 3 | 0 |
| **% Latino** | 1.00 | 0.63 | 0.13 | 0.50 | 0.38 | 0.13 | 0.00 | 0.00 | 0.38 | 0.50 | 0.00 | 0.38 | 0.00 |
| **Num Other** | 23 | 2 | 8 | 16 | 3 | 1 | 3 | 1 | 7 | 9 | 1 | 2 | 4 |
| **%Other** | 1.00 | 0.09 | 0.35 | 0.70 | 0.13 | 0.04 | 0.13 | 0.04 | 0.30 | 0.39 | 0.04 | 0.09 | 0.17 |

Table 5. Demographics of Elkhorn Slough visitors sorted by their stated reasons for visiting. Respondents were able to choose as many reasons for visiting that applied. *AINA = American Indian or Alaskan Native. **NHPI = Native Hawaiian or Pacific Islander.

| | |
|---|---|
| **% of respondents who come to Slough to see wildlife AND indicated that they hope to see otters** | 0.72 |
| **% of respondents who were wildlife watching while kayaking and sea otter looking** | 0.24 |

Table 6. Otter viewing statistics for visitors to the Slough.

| | Count | % |
|---|---|---|
| **Halibut** | 13 | 0.33 |
| **Rockfish** | 13 | 0.33 |
| **Surfperch** | 11 | 0.28 |
| **Sharks** | 9 | 0.23 |
| **Rays** | 8 | 0.21 |
| **Sanddab** | 7 | 0.18 |
| **Salmon** | 7 | 0.18 |
| **Sole** | 5 | 0.13 |
| **Smelt** | 5 | 0.13 |
| **Flounder** | 5 | 0.13 |
| **Shellfish** | 3 | 0.08 |
| **Cabezon** | 3 | 0.08 |
| **Pacific Stag Horn Sculpin** | 1 | 0.03 |
| **Other** | 0 | 0.00 |

**39 Total Responses**

Table 7. Fish species visitors hope to catch while fishing in or near Elkhorn Slough.

| | |
|---|---|
| **% Hope to Catch Flatfish** | 0.59 |
| **Median Expenditures** | $17.68 |

Table 8. Percentage of visitors who hope to catch flatfish while fishing in or near the Slough and their median expenditures per trip.

| Site | Responses |
|---|---|
| **Slough Open Water** | 82 |
| **Tidal Creeks** | 48 |
| **Salt Marsh** | 39 |
| **Open Ocean** | 34 |
| **Mud Flats** | 23 |
| **Oak Wood Lands** | 15 |
| **Chaparral Scrub** | 11 |
| **Ag Land** | 9 |
| **Other** | 0 |

Table 9. Habitat type preferences indicated by respondents who kayak in the Slough. Respondents could choose more than one habitat type.

| | | More Often | Less Often | No Change |
|---|---|---|---|---|
| | **Increase** | $15.00 | x | $20.00 |
| **Saltwater Marsh** | **Decrease** | x | $60.00 | $8.00 |
| | **Increase** | $35.00 | 17.5* | $16.00 |
| **Mudflats** | **Decrease** | 30** | $60.00 | $10.00 |
| | **Increase** | $17.50 | x | $20.00 |
| **Open Water** | **Decrease** | x | $22.00 | $10.00 |
| | **Increase** | x | x | 985* |
| **Access Points** | **Decrease** | x | x | 985* |
| | **Increase** | $5.00 | x | $20.00 |
| **Otters** | **Decrease** | 300** | $22.00 | $8.00 |

**x indicates 0 responses for the respective cell**

Table 10. Median expenditures of visitors sorted by their response to how habitat changes would affect their visitation. All values are based on at least 20 responses unless otherwise noted. * Value based upon 2 responses only. ** Value based upon 1 response only.

| | | Saltwater Marsh | | Mudflats | | Open Water | | Access Points | | Otters | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Increase | Decrease | Increase | Decrease | Increase | Decrease | Increase | Decrease | Increase | Decrease |
| **Total** | | 71 | 70 | 71 | 69 | 71 | 70 | 2 | 2 | 70 | 70 |
| | **Total** | 23 | 0 | 20 | 1 | 24 | 0 | 0 | 0 | 25 | 1 |
| | **Fishing** | 4 | 0 | 2 | 1 | 5 | 0 | 0 | 0 | 4 | 0 |
| **More Often** | **Birding** | 16 | 0 | 12 | 0 | 11 | 0 | 0 | 0 | 13 | 0 |
| | **Wildlife** | 22 | 0 | 19 | 1 | 22 | 0 | 0 | 0 | 24 | 1 |
| | **Kayak** | 9 | 0 | 8 | 1 | 8 | 0 | 0 | 0 | 8 | 0 |
| | **Total** | 0 | 22 | 2 | 19 | 0 | 17 | 0 | 0 | 0 | 21 |
| | **Fishing** | 0 | 3 | 1 | 2 | 0 | 5 | 0 | 0 | 0 | 4 |
| **Less Often** | **Birding** | 0 | 14 | 0 | 11 | 0 | 7 | 0 | 0 | 0 | 12 |
| | **Wildlife** | 0 | 21 | 2 | 18 | 0 | 15 | 0 | 0 | 0 | 20 |
| | **Kayak** | 0 | 10 | 2 | 9 | 0 | 7 | 0 | 0 | 0 | 10 |
| | **Total** | 48 | 48 | 49 | 49 | 47 | 53 | 2 | 2 | 45 | 48 |
| | **Fishing** | 6 | 7 | 7 | 7 | 5 | 5 | 0 | 0 | 6 | 6 |
| **No Change** | **Birding** | 24 | 26 | 28 | 29 | 29 | 33 | 1 | 1 | 27 | 28 |
| | **Wildlife** | 42 | 42 | 43 | 43 | 42 | 48 | 2 | 2 | 39 | 42 |
| | **Kayak** | 18 | 17 | 17 | 16 | 19 | 20 | 0 | 0 | 19 | 17 |

Table 11. Number of responses to the various habitat change scenarios sorted by visitor participation in the 4 recreational activities we asked about in detail.

| | Obs | Median |
|---|---|---|
| **Acess Points** | $76.00 | $7.50 |
| **Mudflats** | $16.00 | $10.00 |
| **Hotels** | $18.00 | $0.00 |
| **Saltwater Marsh** | $40.00 | $10.00 |
| **Shops and Restaurants** | $42.00 | $12.50 |
| **Open Water** | $0.00 | $0.00 |
| **Other Reason** | $44.00 | $20.00 |

Table 12. Visitor expenditures sorted by their response to question 12 ("Would you visit the Slough more often if there were more of the following (check all that apply)?").

| | Total | Fishing | Birding | Wildlife | Kayak |
|---|---|---|---|---|---|
| **Acess Points** | 76 | 18 | 38 | 65 | 23 |
| **Mudflats** | 16 | 1 | 12 | 16 | 6 |
| **Hotels** | 18 | 5 | 4 | 15 | 1 |
| **Saltwater Marsh** | 40 | 4 | 30 | 35 | 17 |
| **Shops and Restaurants** | 42 | 7 | 18 | 34 | 7 |
| **Open Water** | 0 | 8 | 31 | 40 | 20 |
| **Other Reason** | 44 | 3 | 23 | 39 | 11 |

Table 13. Visitor responses to question 12 ("Would you visit the Slough more often if there were more of the following (check all that apply)?") sorted by their participation in the 4 activities we asked about in detail.

| | Total | Hike/Walk | Wildlife Viewing | Fishing | Birding | Kayaking | Other | Didn't Visit |
|---|---|---|---|---|---|---|---|---|
| **Bennet Slough** | 7 | 4 | 3 | 0 | 2 | 1 | 2 | 301 |
| **Moss Landing North** | 133 | 30 | 55 | 11 | 32 | 54 | 32 | 175 |
| **Moss Landing South** | 142 | 70 | 49 | 15 | 18 | 7 | 64 | 166 |
| **Moro Cojo Slough** | 5 | 2 | 1 | 0 | 1 | 1 | 3 | 303 |
| **CDFP Wildlife Area** | 63 | 7 | 20 | 2 | 14 | 50 | 8 | 245 |
| **Seal Bend/Rubis Creek** | 58 | 3 | 18 | 1 | 9 | 50 | 5 | 250 |
| **Moon Glow Dairy** | 20 | 3 | 7 | 1 | 6 | 13 | 1 | 288 |
| **ESNERR South** | 35 | 1 | 8 | 0 | 6 | 30 | 3 | 273 |
| **South Marsh** | 35 | 31 | 24 | 1 | 17 | 2 | 2 | 273 |
| **Visitors Center** | 67 | 57 | 35 | 1 | 26 | 0 | 11 | 241 |
| **ESNERR North** | 47 | 17 | 17 | 0 | 12 | 29 | 2 | 261 |
| **North March** | 5 | 2 | 3 | 0 | 1 | 1 | 1 | 303 |
| **Kirby Park** | 65 | 26 | 17 | 4 | 16 | 28 | 9 | 243 |
| **Hudson's Landing** | 5 | 2 | 1 | 0 | 2 | 1 | 2 | 303 |
| **Porter Marsh** | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 306 |
| **Monterey Bay** | 19 | 10 | 9 | 4 | 2 | 3 | 6 | 289 |

Table 14. Areas of the Slough visited by respondents on their current trip sorted by their participation in the 4 activities we asked about in detail.

| | # of Observations | Median |
|---|---|---|
| **Bennet Slough** | 7 | $15.00 |
| **Moss Landing North** | 133 | $25.00 |
| **Moss Landing South** | 142 | $15.00 |

| | | |
|---|---|---|
| **Moro Cojo Slough** | 5 | $10.00 |
| **CDFP Wildlife Area** | 63 | $60.00 |
| **Seal Bend/Rubis Creek** | 58 | $50.00 |
| **Moon Glow Dairy** | 20 | $30.00 |
| **ESNERR South** | 35 | $50.00 |
| **South Marsh** | 35 | $30.00 |
| **Visitors Center** | 67 | $15.00 |
| **ESNERR North** | 47 | $30.00 |
| **North March** | 5 | $20.00 |
| **Kirby Park** | 65 | $20.00 |
| **Hudson's Landing** | 5 | $20.00 |
| **Porter Marsh** | 2 | $0.00 |
| **Monterey Bay** | 19 | $20.00 |

Table 15. Median expenditures of Slough visitors sorted by the area(s) they visited in the Slough during their current visit.

| | Obs. | Mean Age | Income | | | Race | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % < $60k | % < $150K | % > $150K | % White | %Black | %Asian | %AINA | %NHPI | % Hispanic | %Spanish | % Latino | %Other |
| **Bennet Slough** | 7 | 44.29 | 0.01 | 0.03 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.50 | 0.13 | 0.04 |
| **Moss Landing North** | 133 | 48.01 | 0.43 | 0.43 | 0.48 | 0.45 | 0.00 | 0.62 | 0.20 | 0.25 | 0.35 | 0.00 | 0.00 | 0.57 |
| **Moss Landing South** | 142 | 46.19 | 0.52 | 0.46 | 0.43 | 0.43 | 1.00 | 0.46 | 0.60 | 0.50 | 0.60 | 0.50 | 0.88 | 0.39 |
| **Moro Cojo Slough** | 5 | 38.20 | 0.01 | 0.02 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **CDFP Wildlife Area** | 63 | 47.18 | 0.21 | 0.18 | 0.25 | 0.25 | 0.00 | 0.31 | 0.20 | 0.00 | 0.05 | 0.00 | 0.00 | 0.09 |
| **Seal Bend/Rubis Creek** | 58 | 46.47 | 0.19 | 0.16 | 0.25 | 0.24 | 0.00 | 0.23 | 0.20 | 0.00 | 0.05 | 0.00 | 0.00 | 0.09 |
| **Moon Glow Dairy** | 20 | 48.70 | 0.08 | 0.05 | 0.10 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.09 |
| **ESNERR South** | 35 | 49.11 | 0.10 | 0.10 | 0.13 | 0.13 | 0.00 | 0.08 | 0.20 | 0.00 | 0.05 | 0.00 | 0.00 | 0.13 |
| **South Marsh** | 35 | 50.17 | 0.11 | 0.14 | 0.10 | 0.15 | 0.00 | 0.08 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 |
| **Visitors Center** | 67 | 51.51 | 0.15 | 0.25 | 0.30 | 0.28 | 0.00 | 0.23 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.09 |
| **ESNERR North** | 47 | 50.00 | 0.12 | 0.16 | 0.15 | 0.19 | 0.00 | 0.08 | 0.20 | 0.00 | 0.05 | 0.00 | 0.00 | 0.09 |
| **North March** | 5 | 38.60 | 0.03 | 0.00 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Kirby Park** | 65 | 49.26 | 0.15 | 0.21 | 0.23 | 0.21 | 0.00 | 0.08 | 0.40 | 0.50 | 0.20 | 0.50 | 0.13 | 0.22 |
| **Hudson's Landing** | 5 | 42.40 | 0.02 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 |
| **Porter Marsh** | 2 | 28.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Monterey Bay** | 19 | 41.68 | 0.09 | 0.05 | 0.05 | 0.05 | 0.00 | 0.15 | 0.20 | 0.00 | 0.08 | 0.00 | 0.13 | 0.04 |

Table 16. Basic demographics of Slough visitors sorted by the areas of the Slough they visited during their current trip.

## 10.3 Appendix C: Policy Survey and Brief – Bolsa Chica


**Permitting**

1. Please indicate the Federal and State agencies your group contacted to obtain permissions and permits for your restoration options by marking an "X" in the box to the right of the agency.

| | Federal Agencies | | State Agencies |
|---|---|---|---|
| | US EPA | | Cal EPA |
| X | US Army Corps | X | CA Fish and Game |
| | NMFS | | CA Coastal Conservancy |
| X | US Fish and Wildlife Service | X | CA Water Control Board |
| | US Bureau of Reclamation | X | CA Coastal Commission |
| | | | |

Please list other agencies here.

**- Ten public agencies signed the interagency agreement that allowed the restoration project possible: Ports of Los Angeles and Long Beach, Corps of Engineers, National Marine Fisheries Service, Environmental Protection Agency, Fish and Wildlife Service, Cal Fish and Game, State Coastal Conservancy, State Lands Commission, and California Resources Agency.**
**- State Lands Commission had to complete two a purchase and sale agreements with the private land owner to purchase the land.**
**- State Lands Commission, the resident oil company, and the land seller each signed the contaminant voluntary cleanup agreement.**
**- State Lands Commission had to amend the Surface Use Agreement that allowed the oil company (that owned the mineral rights) to continue operating.**
**- Temporary encroachment permits were obtained from Orange County Flood Control, Caltrans, State Parks, and a private property owner.**
**- State Lands Commission (a project partner and the land owner) issued a construction lease for USFWS construction of the project.**
**- City of Huntington Beach required approval of traffic plans and traffic signals on project entrance gate and a $10,000 design review fee.**
**- US Coast Guard issued a Rivers and Harbors Act Section 9 Bridge Permit.**
**- As project proponent, USFWS performed an ESA internal section 7 consultation that culminated with a Biological Opinion.**
**- State Lands Commission had to obtain a CESA 2081 permit from Cal Fish and Game.**
**- State Lands Commission, who administered Project funds, had to complete reimbursable agreements with USFWS and the oil company.**

**- Cal Fish and Game had to complete a management contract with State Lands Commission for long-term management**

2. Please indicate which permissions/permits your group acquired for your restoration.

___ Section 401 Certified Nation Wide Permit
___ CWA §404 Permits
_X_ Section 404 Individual Permit
_X_ Water Quality Certification
_X_ Waste Discharge Permits
___ Department of Fish and Game's Lake and Streambed Alteration Program
_X_ California Coastal Act: **Federal Consistency Determination** (CZMA)
___ BCDC Permit (SF Bay Area only) (CZMA)
_X_ Rivers and Harbors Act: Section 10 Permit
_X_ Endangered Species Act: Section 7 and 10 Permit
_X_ Other: Please Specify
**See # 1.**

3. Please rank your acquired permits based on the level of ease you experienced in receiving the permit. Please rate on a scale of 1 to 10 with 1 being the easiest and 10 being the most difficult.

___ Section 401 Certified Nation Wide Permit
___ CWA §404 Permits
_6_ Section 404 Individual Permit
_3_ Water Quality Certification
_3_ Waste discharge Permits
___ Department of Fish and Game's Lake and Streambed Alteration Program
_7_ California Coastal Act: **Federal Consistency Determination**
___ BCDC Permit (SF Bay Area only) (CZMA)
_1_ Rivers and Harbors Act: Section 10 Permit
_1_ Endangered Species Act: Section 7 and 10 Permit
___ Other: Please Specify
**10 Caltrans encroachment permit**
**8 State Parks encroachment permit**
**8 City of Huntington Beach traffic plan approval**
**7 Cal Fish and Game CESA 2081 permit**
**7 Voluntary cleanup agreement**
**6 Flood Control encroachment permit**
**5 Private property encroachment permit**
**5 Interagency agreement for the whole project, surface use agreement amendment, purchase and sale agreements.**
**1 Coast Guard Bridge permit**
**1 Reimbursable agreements and construction lease**

a. Did your project fall under CEQA guidelines?
__X_ Yes ___ No

b. If yes, explain how the CEQA process affected your project's start and/or progress.

**At the very beginning (1996), during drafting of the Bolsa Chica interagency agreement, a joint NEPA/CEQA document was envisioned with USFWS and Corps as NEPA co-leads and State Lands Commission as CEQA lead. State Coastal Conservancy was handling the preliminary engineering contract. All the proponents knew that the proposed Project's scale, complexity, and history warranted a full EIR/S level of treatment. Preparation of the EIR/S was actually preceded by many months of self-imposed public workshops and preliminary engineering work. (The Bolsa Chica restoration project had been preceded by 20 years of eco-combat over housing developments in the wetland that included several aborted attempts to complete EIRs and EISs. The restoration Steering Committee, rather than rely on possibly biased engineering analysis from the predecessors, chose to gather and employ current data and state-of-the-art engineering analyses for our decision document.)**

**So, the NEPA/CEQA process did not have any affect upon the Project start. The progress of EIR/S preparation may have been somewhat slower due to the need for multi-agency collaboration and the slight differences in agency practices when compared to single agency lead. However, the benefits of demonstrating agency teamwork and consensus-building completely overrode any such detriment. About 6 months of "delay" in finalizing the EIR/S came from our decision to complete specific engineering analyses in response to certain comments on the draft EIR/S. Having a really solid EIR/S as the basis for the decision to proceed, is important in reducing the likelihood of legal challenges. The true cost in time and dollars was in the engineering analyses needed to accurately predict impacts and then respond to public review comments. (That is, preliminary engineering costs totaled about three times what the preparation of the EIR/S cost.)**

4. a. Did your project fall under NEPA guidelines?
_X__ Yes ___ No

b. If yes, explain how the NEPA process affected your project's start and/or progress.

**See #3 above. We had little difficulty in reconciling the differences between NEPA and CEQA. Some Steering Committee members think that voluminous, excessively detailed documents are wasted on the public, but there was no legal challenge of our documents under either statute. The Executive summary from the FEIR/S is 53 pages alone and the entire document with all its attachments is 7 volumes.**

5. How long did it take you to obtain all the necessary permits and permissions for the restoration activities?

**The Bolsa Chica Restoration Project spanned 10 years from the implementation of the interagency agreement (1997) to opening the new ocean inlet (2006). The EIR/S preparation extended from Scoping in late 1997 to Final EIR/S in 2001. Not all permissions were sought at the same time or in a specific sequence. That is, there was much overlap. The two major permit actions together, Corps 404 permit and Coastal Commission Consistency Determination, consumed approximately nine months. The Corps took about four months to produce a public notice followed by about 8 months to issue the permit in 2002. The Coastal Commission Consistency Determination took a total of 6 months, with adoption of findings in early 2002. Neither agency facilitated their process just because it was a restoration project and not a port terminal or housing development. Both required separate and additional public review steps, despite the absence of significant opposition or controversy. Both wanted the other to have completed their process before completing their own. Ultimately, in spite of the disconnected, parallel nature of their considerations, the mitigation measures and project description were the same in both of these regulatory processes and consistent with the EIR/S mitigation measures and project description. It is a major struggle for these two regulatory bodies to discriminate wetland restoration from the usual environmentally damaging development project.**

**In keeping with "the devil's in the details" paradigm, several of the minor permissions took far longer than necessary and threatened significant project delays. This was due to the permitting entity trying to extort unrelated benefits to themselves by intentionally slowing their processing to gain leverage on the Project. Those agencies that tended in this direct would be Caltrans, State Parks, OC Flood Control, and City of Huntington Beach.**

**Restoration**

6. How would you classify the nature of your restoration site?
___Mostly Rural ___A mix of Rural and Urban _X_ Mostly Urban

**About half of all Californians live within 50 miles of the coast in Ventura, LA, Orange, and San Diego Counties. Urban sprawl has filled in almost continuously along this entire length. Bolsa Chica had been threatened continually for 20 years with further destruction and degradation. The surviving remnant of the historic tidal salt marsh ecosystem was about 60% of its former extent and severely degraded by being cut off from the ocean and the construction of oil field roads and facilities.**

7. What type of restoration activities did your site undergo? Please check all that apply

_X_ Large amounts of sediment added
_X_ Changes in tidal prism
_X_ High levels of pollution addressed
_X_ Movement of major roadways
___ Other: Please describe below

- **New ocean connection across the ocean beach with jetties and revetment**
- **Two new bridges over the new ocean inlet**
- **Oil well abandonment and removal**
- **Addition of custom-designed water control structures**
- **Barrier to groundwater movement**
- **Construction dewatering to work in soft soils with shallow groundwater**

8. a. If large amounts of sediment were added, how much sediment was added?

**The Bolsa Chica restoration project, by design, largely had a balance of onsite cut and fill. By the time we were completing Final Design (just before we bid the job out for construction) we had a pretty detailed "dirt budget". That is, we had identified source-destination-amount for every cubic yard of sediment. Fill volume:**

| | |
|---|---|
| **Fill for Levee/Overlooks/Nest Sites** | **1,000,000 cubic yards** |
| **Sand in surf zone (ebb shoal)** | **750,000 cubic yards** |
| **Sand on State Beach** | **130,000 cubic yards** |

b. What was the goal of adding the sediment?

**The levees had to be built high and strong enough to safely contain a full tidal range and storm surge. (Most of the adjacent residential area and remaining oil field is below mean sea level.) The overlooks were added along the levee to improve the visual and interpretive qualities of the public access along the levee. The nest sites were intended to expand the ground nesting opportunities without the threat of flooding, primarily for the endangered California least tern and the Threatened western snowy plover. Clean sand was placed on the beach and in the ebb shoal (just outside the inlet mouth) to enhance the beach and reduce the likelihood that beach erosion may occur. We also placed several thousand cubic yards on about 40 acres within the full tidal basin to raise it up to the optimal intertidal elevation for cordgrass growth to benefit the endangered light-footed clapper rail.**

c. How was the sediment obtained?

**All of the above sediment came from the 175-acre excavated within the full tidal basin. We had completed thorough soil testing in order to map sediments in three dimensions based on particle size and contamination. Clean sand was destined for the beach, silty sand and smaller sized sediment was used to build levees and nest sites, while contaminated material was sequestered in the core of two nest sites and an overlook.**

d. What permits were needed to proceed with this restoration activity?

**As stated above, the primary permits were Corps CWA 404 permit for discharge of dredge or fill material in waters or wetlands of US, and Coastal**

**Act Federal Consistency Determination. A RWQCB stormwater permit was needed to dewater the construction site so that contaminants and non-sand sediment could be removed using heavy equipment. No local grading permits were necessary.**

9. a. If tidal prism change was sought, how did your site achieve this?
**A primary restoration goal was to restore as much tidal influence (full ocean tide range) as possible. Bolsa Chica was once a full tidal salt marsh ecosystem with an ocean connection, but for the last century it was cut off from tidal influence and much urban infrastructure. For the last 50 years it has been an operating oil field, as well.**

**After analyzing many different alternatives, the adopted restoration alternative would place the new ocean connection at the opposite end from the historic location. A new channel had to be excavated across Bolsa Chica State Beach. This also required some physical reshaping of the topography inside the full tidal basin (~367 total acres) to achieve the sought after proportions of subtidal and intertidal habitats. Existing oil wells could not be protected in place so that ultimately 64 oil wells had to be bought out and removed. Oil access roads and contamination were also removed. Jetties were necessary to stabilize the inlet location across the beach and two bridges were needed to maintain traffic flow along Pacific Coast Highway and access to oil wells over the new inlet.**

**Another 223 acres were designed to receive a muted tidal influence. (Tidal influence had to be restricted so as to avoid significant impacts to oil wells, houses or water supply channels from a larger tidal prism. Grading within the muted tidal areas was minimal and primarily done to assure good water circulation. Three custom designed water control structures were designed and constructed through the levees to connect the muted tidal areas to the full tidal areas.**

**The Bolsa Chica pre-project condition was characterized as having wetland/alluvial soils, near surface groundwater, and seasonal flooding. Our groundwater modeling suggested that restoring tidal influence could, under some conditions, aggravate seawater influence of the shallow aquifer underneath the adjacent residences that were build in historic wetland. To prevent this from ever happening, a groundwater movement barrier (Plastic sheet file driven 30 feet into the ground) was built between the wetland and the houses. This will stop any movement of seawater inland under the houses. A groundwater extraction system was installed next to the houses to prevent the freshwater groundwater from rising to the surface under the houses because the barrier blocks flow.**

b. What permits were needed to proceed with this restoration activity?

**Same as above. To build the PCH bridge and inlet required the encroachment permits from Caltrans and State Parks. Bridges were built before the inlet existed but Coast Guard issued a permit for the bridges.**

10. If high levels of pollutants were addressed, please describe how this activity was addressed in your restoration activities.

**Much of the Bolsa Chica lowland was an operating oil field for 50 years before it was acquired into public ownership, not to mention a sump for some urban runoff. The voluntary cleanup agreement with the oil company and the property seller has been implemented roughly as follows. USFWS chaired an interagency technical committee that characterized the nature and extent of contamination on the site. The tech committee produced an Ecological Risk Assessment, and from that, recommendations for cleanup goals. (The cleanup goals adopted by the Steering Committee, State Lands Commission with concurrence by RWQCB for Bolsa Chica are very protective of fish and wildlife.) Our detailed and thorough soil sampling within the excavation area (done primarily to satisfy the Corps "green book" standards for nearshore deposition of sand in a beach littoral drift system) allowed 3-D mapping of clay/silt, contaminants, and clean sand. The grading plans for the full tidal basin included this soil categorization and allowed excavations to remove contaminants and non-sand with heavy equipment. (Later, the full tidal basin was partially filled with seawater to float a hydraulic dredge so the remaining clean sand could be pumped to the ebb shoal.) The oil company has finished cleanup in the muted tidal areas, but continues to work on the Future Full Tidal and Seasonal Pond areas.**

**A 42-acre parcel of historic wetland was purchased by the State after restoration construction had started. PCB's had been discovered there during the USFWS site characterization. The purchase and sale agreement between the private party and State Lands Commission agreed that the restoration construction contractor would complete the PCB cleanup with DTSC oversight and the cleanup cost would be deducted from the purchase price. Once the details were settled, this actually worked well and the parcel was incorporated into the restoration project muted tidal area.**

11. If major roadways were moved, please describe the permits that were needed to proceed.

**Pacific Coast Highway (PCH) is aligned along the beach strand between the Bolsa Chica wetlands and the ocean beach. To reestablish the ocean connection that would supply a full tidal range to the restored wetland, a new inlet had to be excavated through PCH and the beach. A new bridge had to be constructed to maintain PCH traffic flow. In order to maintain traffic flow even during construction of the new bridge within the existing right-of-way, a detour had to be constructed. The detour, while across project land, could interfere with the oil company access to existing State lease oil wells. Also, the drip line of the new bridge and abutment shoulders would very slightly extend into State Beach**

**property. Caltrans required an encroachment permit for the Project to accomplish the detour and the bridge construction. They required three different written agreements and all right-of-way issues resolved, not to mention review and approval of design plans, before they would provide the encroachment permit. They had attempted to force the restoration project to widen PCH to six lanes for two miles next to Bolsa Chica until the Coastal Commission put their foot down. The oil company and the State had to complete a reimbursable agreement to address "lost revenue" in case the PCH detour blocked their access should a producing oil well become dysfunctional.**

12. a. Please describe the types of permits that were needed to proceed with other restoration activities you indicated in question 7.

**- New ocean connection across the ocean beach with jetties and revetment**
**State Parks required an encroachment permit to construct the inlet across the State Beach. They sought multiple concessions from the restoration project that were unrelated to Project activities or impacts.**
**- Two new bridges over the new ocean inlet**
**See #11. Coast Guard permit issued well in advance**
**- Oil well abandonment and removal, relocation of certain oil field facilities**
**This required two separate reimbursable agreements between State Lands Commission and the oil company.**
**- Addition of custom-designed water control structures**
**No additional permit needed**
**- Barrier to groundwater movement**
**No additional permit needed**
**- Construction dewatering to work in soft soils with shallow groundwater**
**RWQCB stormwater discharge permit monitoring and reporting**

b. What were the principle obstacles you encountered?

13. a. What was the total cost of the restoration?

**Total Bolsa Chica project costs ~$147 million**

| | |
|---|---|
| - acquisition | $26.5 million |
| - agency work and documentation | $ 5.5 million |
| - oil well buyout and abandonment | $11.8 million |
| - all construction contracts | $86 million |
| - operations and maintenance endowment | $15 million |
| - future full tidal endowment | $ 2.5 million |

b. How did this compare with the original estimates?

**If the "original estimates" are those used 10 years earlier when the interagency agreement was implemented, the answer is about $80 million. However, the cost estimate was continually updated using much better information. The most significant cost estimate updates were when the construction contract bid solicitations were received and the Steering Committee had to decide whether to proceed or not given the cost estimate**

**and promised/available funds. Then, in the midst of construction, $10 million of promised funds failed to materialize. The Steering Committee was forced to consider scaling back intended Project accomplishments, using O&M endowment funds for construction, or raising more funds.**

14. Did your restoration efforts seek to slow or reverse the conversion of salt marsh to a more marine environment? If so, what factors most influenced your decision to restore or preserve salt marsh environments? If not, please disregard this question.

**No, the primary objective is to reverse the long-standing trend of coastal wetland loss and degradation attributed to urbanization. Tidal salt marsh and mudflats are among the most severely diminished wetland habitat types of southern California, primarily due to human construction of ports, marinas, residential housing, commercial buildings, roads, railroads, salt works, power plants, parking lots, flood channels, etc.**

**Global warming and sea level rise is discussed in the EIR/S and it is thought that the Bolsa Chica restoration plan would address the next 100 years. If sea level rise is faster than evaluated or continues unabated, each coastal wetland will eventually have to address the loss of vegetated wetlands and intertidal mudflats. In southern California, wetland transition zone have largely been eliminated by allowing development to occur right down to the existing wetland boundary. Thus, upward adjustments of the intertidal zone are largely not possible. Some upward adjustment of the marsh plain by spraying of clean sediment over existing salt marsh is now being talked about in southern California, but may prove to be a localized and short-term solution.**

15. What advice would you offer to other estuarine managers attempting its first restoration in order to increase the ease and efficacy of restoration efforts?

**- Having a consensus work plan or agency cooperation agreement is a very good idea for the "core" participants. Hopefully, it would provide a little glue to keep team members together, "eyes on the prize", and reduce the detrimental affects of staff turnover. Partnerships where each participant can bring something to the table are especially valuable. (Large diverse groups tend to include "second-guessers", and hobbyists, and/or those with the hidden agenda.)**
**- Try to establish a good collaboration between coastal engineer and biologist no later than the preliminary engineering phase. The biologist will typically know where the restoration project needs to go, while the engineer will likely know the way there.**
**- Give the regulatory agencies every opportunity to stay updated and involved in planning and design but be prepared to keep moving if they don't participate.**

16. a. Has the progress of the restoration been tracked?

_X_ Yes ___ No

b. If so, has the restoration met its intended expectations and goals? Please explain.

**As measured by completion of construction in accordance with the plans and contract, the Bolsa Chica restoration project fully met its expectations. In the**

**first year of physical performance, some areas of sand deposition in the inlet, as well as some erosion off overlooks and nest sites, has been greater/faster than expected. The O&M endowment is thought to be sufficiently funded to cover many decades of operations and maintenance. This assumes we have made reasonably accurate predictions about maintenance dredging frequency and sand volumes and assumes wise and parsimonious use of funds by the long-term land manager. The physical and biological monitoring required by Corps and CCC approvals has only just begun and will continue for many years. The last biological evaluation will be in year-ten, 2016. Some of the biological benefits have already been seen, e.g. fish in the tidal basin, ground-nesting birds on the new nest sites.**

17. Is there anything pertaining to the restoration that you would do differently based on what you know now? Please explain.

**I would get written commitments/letters of intent of promised funds before proceeding with a construction contract.**

**Economic Activities**

18. Please indicate the economic activities that are present in the area surrounding the estuary.

___ Power plant operations
___ Harbor operations
___ Fishing
_X_ Tourism
___ Agriculture
___ Other: Please describe below

- **Outdoor education**
- **Ecotourism/birding**
- **Transportation, PCH is a major arterial thoroughfare**
- **Beach recreation, sunbathing, surfing, cycling, walking**
- **Oil field operations**

19. Were economic activities you indicated above impacted by the restoration activities? Please explain.

**Primarily, impacts stemmed from temporary construction activities and were insignificant or very minor. The public access trails had to be closed to the public to allow safe construction. Ecotourism visitors, birding tours, and outdoor education class trips along the trail (levee top) had to stop at Bolsa Chica during that time. Construction of the inlet and ebb shoal slightly constrained the areas where safe surfing, surf fishing, body surfing, and sunbathing could be conducted but the vast lengths of beaches in the area were unaffected. One small State Beach parking lot had to be temporarily closed to the public during construction. The regional multipurpose trail along the beach had to be detoured through the construction zone. The oil company made "lost revenue" claims due to the PCH detour blocking their oil well maintenance**

**access. The heavy traffic load on PCH was unimpeded and a notorious flooding zone of the highway was eliminated by the new bridge. (However, some of the cycling community did not like being told they should avoid the PCH detour for safety reasons.) Recreational fishing at the new inlet is very popular. (The fish nursery function of the restored tidal wetland will indirectly benefit recreational fishing, particularly those targeting California halibut.) The ebb shoal construction is said to have beneficially changed the surf break. The new trails and overlooks are very popular. The routing of the beach multi-user trail up onto the PCH bridge but separate from the traffic lanes is also quite popular.**

**Stakeholders**

20. How did you communicate and negotiate with constituents/stakeholders in your area? Did you formulate a process? Please describe.

**The 8-agency Steering Committee met regularly and made strategic decisions by consensus. Different agencies would take the lead on particular issues, but all would participate under some circumstances to be mutually supportive. We did not have a formal Outreach Plan, but we had talked everything through and cooperated on everything, using appropriate assets from each agency.**

**For the ten year period between property acquisition and opening the new inlet, we conducted on average semi-annual public workshops, update sessions, town hall meetings. The Project printed a newsletter roughly twice a year. FWS maintained the official project web page. During the two years of construction, we had monthly update meetings with the NGO/support groups and were regularly invited to speak to such groups as the City environmental board, public works commission. Also during construction, we had weekly contractor coordination meetings which were also attended by the other stakeholder agencies, such as Caltrans, State Parks, and the oil company. During construction we maintained a telephone information line. This phone number and the web page URL were on signs beside the adjacent public roads. We also mass produced a three-fold leaflet of project information (plus phone number and URL) that was placed at two information kiosks we had constructed at key public access points. The kiosks housed a large information poster and other Project information. Telephone or email public inquiries, comments, or complaints received quick responses. News media interest was always satisfied, as were invitations to speak or discuss the Project, even from potentially hostile parties.**

21. What was the single most important factor in your final decision to restore, and how was this decision received by your constituents/stakeholders?

**(I'm not sure what you mean by "final decision" and I don't think I understand the point of the question.) There are many decision points where one evaluates whether or how to proceed. The decision to sign the founding agreement was widely celebrated. It stopped the eco-war that had been Bolsa Chica for the 20 preceding years and opened wide the doorway to restoration. (A minority**

**opinion was that restoration funds should have been used to acquire all of the private property, including the Bolsa Chica Mesa, primarily on open space conservation grounds.) Years later, in adopting an alternative at the completion of the EIR/S, the primary consideration was "the optimal project for fish and wildlife" and the wetland ecosystem. A very small group of individuals argued against the adopted alternative, mainly on emotional grounds rather than practical or factual grounds. In deciding to proceed with construction after opening the bids, availability of sufficient funds to complete the project was most important. State beach managers always disliked the inlet crossing of the beach, but State-level DPR always supported the restoration. Caltrans, suffering institutional budget deficits was quite aggressive in seeking to divert wetland restoration funds to transportation purposes. The oil company always had its hand out for Project funding to offset every perceived claim.**

22. Is there anything you would change about the stakeholder process you used?
**You might get 8 slightly different answers from the 8 different Steering Committee agencies, but on the whole we might think we did something right of have been successful. I probably would try to place even more emphasis on the Steering Committee as the symbol/title of the interagency partnership that endured for 10 years and successfully completed a very complex and expensive restoration project. Perhaps a more authoritative title that indicated a strong support for wetland restoration would have had more impact. Stakeholders might have been facing one or two agencies in a negotiation but they would know that there were eight agencies "in the room".**

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## Bolsa Chica Brief

**Background**
Bolsa Chica, located in Orange County, California adjacent to the City of Huntington Beach began restoration on 600 acres of tidal wetland in 2004. The restoration incorporated many different options to reestablish tidal flow from the ocean and increase habitat. To achieve the biological benefits of tidal restoration, a direct connection to the Pacific Ocean was reestablished through the creation of a new tidal inlet that cut through Bolsa Chica State Beach and across the Pacific Coast Highway near the Huntington Mesa. Restoring the ocean connection required the construction of two new bridges, one for the Pacific Coast Highway and one to provide continued access to the existing oil field operations. A total of about 2.7 million cubic yards of dredge material were removed with about 1.3 million cubic yards of clean sand going to the ebb shoal just off shore of the inlet and about 1.4 million cubic yards to build the tidal basin containment berms and nesting areas.

**Interagency Agreement**
In 1997, eight state and federal agencies entered into an agreement to establish project for wetland acquisition and restoration at Bolsa Chica. Two recommendations were made prior to the approval of this agreement: 1) certification of the final EIR as provided within the California Environmental Quality Act (CEQA), and 2) adoption of the proposed project identified in the final environmental document. The U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers, the federal lead agencies, each need to issue a Record of Decision (ROD) on the final EIS as provided by the National Environmental Policy Act (NEPA).

Under a separate agreement, the Ports of Los Angeles and Long Beach provided $25 million in funding to acquire the privately held Bolsa Chica land. Additionally, $54.6 million was provided by the Ports for restoration of the tidal marsh and the purchase of the remaining oil production and abandoned oil operations to provide a full tidal area. In exchange, the Ports received environmental mitigation credits necessary to undertake fill in the San Pedro Bay for expansion of their multi-modal cargo facilities.

**Concerned Parties**
The Surfrider Foundation indicated concerns regarding the effects of the new ocean inlet on beach erosion and water quality, specifically whether contamination from wildlife would increase beach closures. The FEIR/EIS concluded that with mitigation and monitoring, there was no significant adverse effect of the inlet on beach or down coast erosion.

**Coastal Conservancy Permit**
On March 25 2004, the Conservancy approved a grant of $10 million to the State Lands Commission to restore 566 acres of Bolsa Chica. The authorization limited the expenditure of the Conservancy funds to certain elements of the project: the muted tidal basin, pocket muted tidal basin, nesting islands and groundwater barrier. Since the project area was acquired in 1997, the cost of restoration has increased to approximately $105 million, excluding acquisition, operation and maintenance costs. In August 2005, revised agreements between the Ports and the Coastal Commission allowed the Ports to make additional mitigation payments totaling $22.4 million for additional mitigation credits. The funding shortfall which increased to $18 million was covered. Port funds not used were set aside for adaptive management and maintenance of the restored site.

**Department of the Army Permit**
The permit authorizes the approximate 1.8 million cubic yards of dredge material removed from the basin as well as the redistribution of the material to other locations within the project area. 1.8

million cubic yards of dredge material will be removed from the basin to create the full tidal basin. The basin would then be deepened to support depths varying between 6.8 feet below mean sea level (MSL) and 6.0 feet below MSL. Dredge material was also used to prefill the ebb bar. The remainder of the dredge material was used to create the full tidal basin levees (456,000 cubic yards), three nesting areas (98,300 cubic yards), beach nourishment fills (190,000 cubic yards), and a raised intertidal shelf for cordgrass (98,300 cubic yards). As much as 253,000 cubic yards were hauled off site.

**CCC Consistency Determination**

Under the Coastal Act, the project must be consistent to the maximum extent practicable with the California Coastal Management Program (CCMP). Coastal States prepare Coastal Management Programs under the Coastal Zone Management Act, which Congress enacted in 1972 to encourage coastal states to develop comprehensive programs to manage and balance competing uses of and impacts to coastal resources. Once the federal government approves a state's Coastal Management Program (CMP), that state gains federal consistency review authority. California's CMP was federally approved in 1977 and contains two designated coastal zone management agencies that implement the federal consistency provisions: (1) the California Coastal Commission (CCC) for all coastal areas outside San Francisco Bay; and (2) the San Francisco Bay Conservation and Development Commission (BCDC) for the coastal areas in San Francisco Bay. (The CCMP also includes the California Coastal Conservancy, 'which purchases, protects, restores, and enhances coastal resources, and provides access to the shore'.)

Consistency determinations are submitted by federal agencies. Consistency certifications are for projects requiring a federal permit, authorization, or funding. The Consistency Determination review period is up to 75 days. The Consistency Certification review period is up to 6 months. Applicants may extend either of these time periods. Note also the "90 day" rule for consistency determinations in 15 CFR §930.36(b): "The consistency determination shall be provided to State agencies at least 90 days before final approval of the Federal agency activity unless both the Federal agency and the State agency agree to an alternative notification schedule."

**Ecological Risk Assessment**

The Ecological Risk Assessment evaluates the contaminants present at the site which are at concentrations that present a risk to fish, wildlife or their habitat. The ERA identifies exposure pathways and associated site-specific assessment end-points. The ERA also characterizes the ecological effects of the contaminants of concern. Overall, several chemicals pose various levels of risk to terrestrial and aquatic species. Most notably, metals, pesticides, PAHs, and TPH-diesel and waste oil consistently showed possible and probable risks to species.

## 10.4 Appendix D: Policy Survey and Brief – Morro Bay

NATIONAL OCEAN ECONOMICS PROGRAM

**NOTE – This is all in reference to a stream and floodplain restoration project in the Morro Bay Watershed. I can provide more details on the project upon request.**

**Permitting**

1. Please indicate the Federal and State agencies your group contacted to obtain permissions and permits for your restoration options by marking an "X" in the box to the right of the agency.

| | Federal Agencies | | State Agencies |
|---|---|---|---|
| | US EPA | | Cal EPA |
| X | US Army Corps | X | CA Fish and Game |
| X | NMFS | | CA Coastal Conservancy |
| X | US Fish and Wildlife Service | X | CA Water Control Board |
| | US Bureau of Reclamation | | CA Coastal Commission |
| | | | |

Please list other agencies here.

The Army Corps is the lead on the 404, the other federal agencies provide required input to the Corps, they then work through

2. Please indicate which permissions/permits your group acquired for your restoration.

___ Section 401 Certified Nation Wide Permit
_X CWA §404 Permits
___ Section 404 Individual Permit
___ Water Quality Certification
___ Waste Discharge Permits
_X Department of Fish and Game's Lake and Streambed Alteration Program
___ California Coastal Act: Coastal Development Permit (CZMA)
___ BCDC Permit (SF Bay Area only) (CZMA)
___ Rivers and Harbors Act: Section 10 Permit
___ Endangered Species Act: Section 7 and 10 Permit

X Other: Please Specify:

*We needed a stormwater pollution prevention plan (SWPPP) for the Water Board due to soil disturbance*

*We also needed a County Permit, which serves as the Coastal Act Permit as well.*

3. Please rank your acquired permits based on the level of ease you experienced in receiving the permit. Please rate on a scale of 1 to 10 with 1 being the easiest and 10 being the most difficult.

_2 Section 401 Certified Nation Wide Permit
_8 CWA §404 Permits SLOW SLOW SLOW
___ Section 404 Individual Permit
___ Water Quality Certification
___ Waste discharge Permits
_3 Department of Fish and Game's Lake and Streambed Alteration Program
___ California Coastal Act: Coastal Development Permit (CZMA)
___ BCDC Permit (SF Bay Area only) (CZMA)
___ Rivers and Harbors Act: Section 10 Permit
___ Endangered Species Act: Section 7 and 10 Permit
___ Other: Please Specify
Stormwater plan – easy, costs $$ to pay independent contractor to create the plan.
County Permit – moderate (4?)

4. a. Did your project fall under CEQA guidelines?
X Yes ___ No

b. If yes, explain how the CEQA process affected your project's start and/or progress.

Because our project was funded through a CDFG grant, CDFG completed a blanket CEQA encompassing all their grant funded project so that effort was minimal for us.

5. a. Did your project fall under NEPA guidelines?
X Yes ___ No

b. If yes, explain how the NEPA process affected your project's start and/or progress.

Similarly, the NOAA/NMFS agency staff did much of the NEPA work, based on the CDFG CEQA document template, because we had a grant from NOAA.

6. How long did it take you to obtain all the necessary permits and permissions for the restoration activities?

Over 9 months – most of which seemed to be due to backlog/inaction by the agencies proceesing our applications

**Restoration**

7. How would you classify the nature of your restoration site?
X Mostly Rural ___A mix of Rural and Urban ___Mostly Urban

8. What type of restoration activities did your site undergo? Please check all that apply

___ Large amounts of sediment added
___ Changes in tidal prism
___ High levels of pollution addressed
___ Movement of major roadways
___ Other: Please describe below

Remove failed culverts and stream crossings, remove artificial berms affecting drainage and wetlands. recountour channel and floodplain, extensive revegetation.

9. a. If large amounts of sediment were added, how much sediment was added?

NA

b. What was the goal of adding the sediment?

NA

c. How was the sediment obtained?

d. What permits were needed to proceed with this restoration activity?

10. a. If tidal prism change was sought, how did your site achieve this?
NA

b. What permits were needed to proceed with this restoration activity?

11. If high levels of pollutants were addressed, please describe how this activity was addressed in your restoration activities.

12. If major roadways were moved, please describe the permits that were needed to proceed.

13. a. Please describe the types of permits that were needed to proceed with <u>other</u> restoration activities you indicated in question 7.

b. What were the principle obstacles you encountered?

14. a. What was the total cost of the restoration?

$800,000

b. How did this compare with the original estimates?

Increase of ~75%.

15. Did your restoration efforts seek to slow or reverse the conversion of salt marsh to a more marine environment? If so, what factors most influenced your decision to restore or preserve salt marsh environments? If not, please disregard this question.

NO

16. What advice would you offer to other estuarine managers attempting its first restoration in order to increase the ease and efficacy of restoration efforts?

17. a. Has the progress of the restoration been tracked? – Will be, implementation to start in 1 week.

___ Yes ___ No

b. If so, has the restoration met its intended expectations and goals? Please explain.

18. Is there anything pertaining to the restoration that you would do differently based on what you know now? Please explain.

Our early cost estimating procedures will be significantly revised to better reflect likely true costs. Part of this is factoring in the 3-5 years of inflation in materials and labor between the time that grant applications are being crafted and actual construction is likely to proceed. That alone was a large part of our increase in costs.

**Economic Activities**

19. Please indicate the economic activities that are present in the area surrounding the estuary.

___ Power plant operations
___ Harbor operations
___ Fishing
___ Tourism
_X Agriculture
___ Other: Please describe below

20. Were economic activities you indicated above impacted by the restoration activities? Please explain.

Some impact on grazing operations – we are limiting cattle access to the creek.

**Stakeholders**

21. How did you communicate and negotiate with constituents/stakeholders in your area? Did you formulate a process? Please describe.

Not really required in this case, but we did work with affected parties early and throughout to avoid any last minute surprises for either us or them.

22. What was the single most important factor in your final decision to restore, and how was this decision received by your constituents/stakeholders?

Highly degraded condition of this stream reach, and potential for connectivity with recent and planned restoration both upstream and downstream.

23. Is there anything you would change about the stakeholder process you used?

Some of our cost overruns came from being too generous in trying to accommodate stakeholder input received late in the process which lead to expensive re-design of project elements. In this case the issues raised and the benefits of the design changes were not worth the cost and hassle.

Maybe a better way to say this is that there is a time in the project, before final design work, where stakeholder input is critical and can be considered for inclusion in the plans. But there is a time point past which it becomes very difficult/expensive to make even minor changes, and that needs to be clear to participants and managed accordingly.

## Morro Bay Brief

**Background**
Morro Bay is a small estuary and harbor of 2,300 acres which flows into the Pacific Ocean near the easternmost extent of Estero Bay. The naturally shallow lagoon is located in San Luis Obispo County on the central coast of California approximately 100 miles south of Monterey Bay and 60 miles north of Point Conception. Morro Bay is approximately four miles long (in a north-south direction) and less than 2 miles wide (in an east-west direction) at its widest point. Morro bay receives freshwater input from the perennial Los Osos and Chorro Creeks as well as from groundwater seeps. Much of the bay is extremely shallow and the entire bay is influenced by tidal flushing. The mouth of the bay is engineered and dredged.

In 1995, Morro Bay was nominated by the Governor and accepted by the U.S. Environmental Protection Agency (U.S. EPA) for funding through the National Estuary Program (NEP), under Section 320 of the Clean Water Act. The first goal of the NEP is to prepare a Comprehensive Conservation and Management Plan (CCMP) that identifies the problems that impact the estuary and an action plan for correcting them. Over the past six years, U.S. EPA has awarded approximately $500,000 in grant funding to the State Water Resources Control Board for the preparation of the CCMP. This goal was recently completed when the Governor approved the CCMP in November 2000 and the U.S. EPA Administrator approved it in January 2001.

**Morro Bay Partners in Restoration Program**
An agreement between the Corps, the Coastal San Luis Resource Conservation District (CSLRCD), and the Natural Resources Conservation Service (NRCS) seeks to join efforts to preserve, protect, and restore aquatic resources in the sensitive Morro Bay watershed in central California. On Nov. 21, the Los Angeles District agreed to provide 30-day processing of nationwide permit applications for projects that qualify under the "Morro Bay Partners in Restoration Program" (PIR). The groups' goal is one-stop regulatory shopping. PIR programs thin the thicket of regulatory review, thereby removing disincentives for farmers, ranchers and rural landowners otherwise discouraged by the time, cost and complexity of rules governing their management practices. The Morro Bay PIR program consists of a series of regulatory agreements and permits issued to the NRCS and CSLRCD that cover a specific set of activities/best management practices within a strictly defined geographic area, in this case the Morro Bay watershed.

**California Ocean Protection Council**
In January 2006, Cal Poly's Center for Coastal Marine Science, requested up to $500,000 in matching funds to develop an Ecosystem Based Management Program for the Morro Bay region. This program was described as a high priority for ocean conservation, and it was the decision of the California Ocean Protection Council to authorize the Secretary to take the actions necessary for the planning and implementation of this project, including the allocation of up to $500,000.

**Coastal Conservancy**
In February 2003, Cal Poly's Center for Coastal Marine Science, requested up to $500,000 in matching funds to development of the Morro Bay Ecosystem Based Management Program. The objectives were:

1. To develop and monitor relevant physical/chemical, biological, and socioeconomic indicators across the ecosystem and to determine how the various components are interconnected and how they affect one another;
2. To establish a clear understanding of the institutional linkages within the ecosystem and to build and reorganize the "institutional ecosystem" where needed;

3. To provide land managers and stakeholders with improved ecological and sociological data for shared deliberation and decision making on an ecosystem-wide basis for maximum impact and cost effectiveness; and
4. To develop a model for EBM that can be utilized in other areas of California, the nation, and the world.

**Morro Bay Power Plant**

Duke Energy Morro Bay LLC operates an electric generation plant installed in the 1950s on the former Navy base site adjacent to the causeway connecting Morro Rock with the mainland. The plant has been in nearly continuous operation for more than 50 years. A permit application for plant modernization was submitted to the California Energy Commission. Modernization would increase plant efficiency, relocate plant facilities away from the shoreline, and reduce cooling water withdrawal volumes. Currently, under the proposed plant modernization, the plant withdraws cooling water from Morro Bay at the existing intake structure adjacent to the causeway and discharges through existing discharge tunnels to Estero Bay, north of the Morro Bay entrance channel. Average cooling water withdrawals are 437 million gallons per day. Projected withdrawals after modernization are 328 million gallons per day.

**Army Corps of Engineers Ecosystem Restoration Feasibility Study**

This report is an analysis of the existing conditions and projected future without project conditions. The purpose of the restudy is to formulate an engineeringly sound and economically feasible solution to the potential adverse environmental effects of sedimentation, tidal circulation and flushing restrictions, and degradation of valuable open-water and inter-tidal habitat within the Morro Bay Estuary. The goal of the analysis is to identify restoration alternatives that will restore significant ecosystem function, structure, and dynamic processes that have been degraded. The ecosystem problems and restoration opportunities identified in this report were to be used in the preliminary screening of alternative improvement measures.

Several alternatives were considered in the Feasibility Report:

1. No action

***Dredge-based alternatives***

2. Remove wind driven sand from Morro Bay
3. Dredge existing sediment deposition areas within the Bay
4. Reconfigure bay bottom and channelization to enhance circulation and flushing

***Sand spit stabilization***

5. Establish sand control structures on the sand spit
6. Breach or construct a culvert through the sand spit.
7. Breach or construct a culvert through the causeway to Morro Rock

***Island creation***

8. Create islands in bay for protected bird and pinniped habitat

***Restrictions on human use***

9. Restrict human encroachment on selected areas of Bay and spit.

**Comprehensive Conservation Management Plan**

The Comprehensive Conservation and Management Plan is a plan to address seven priority problems causing harmful impacts to the Morro Bay National Estuary. From the many cross cutting actions such as urban runoff, stream geomorphology, and TMDL allocations, to specific actions under each priority problem, the CCMP strives to sustain existing wildlife resources and environmental quality. There are 61 "Action Plans." These actions have been

developed based on information from scientific studies, the goals, and objectives of the NEP, the priority issues, and significant stakeholder input.

***Cross Cutting Actions***

1. Acquire and protect lands with ecologically valuable habitat and/or beneficial functions
2. Reduce drainage problems by acquiring detention and retention areas
3. Develop and implement Total Maximum Daily Loads (TMDLs)
4. Implement urban storm water Best Management Practices (BMPs)
5. Maintain, restore, and enhance stream morphology and water quality for steelhead
6. Expand and maintain the existing Volunteer Monitoring Program (VMP)
7. Establish a Watershed Crew to provide planning, labor, outreach and mapping services.

***Priority Issues***

1. Sedimentation
    - Reduce sedimentation into the estuary and increase clarity of estuary waters
    - Decrease erosion from upland areas
    - Minimize agricultural soil loss, increase stakeholder involvement; implement BMPs
    - Decrease the rate of shoreline erosion and dune migration
    - Reduce bedload (in-stream) and stream bank erosion
2. Bacteria
    - Reduce the length of closures for restricted shellfish lease areas and meet standards for water contact recreation
    - Decrease levels of bacteria originating from live-aboard boats
    - Minimize bacterial pollution from wildlife, domestic pets and horses
    - Promote consistent and comprehensive water quality standards and monitoring efforts
3. Nutrients
    - Reduce the concentration of nitrates in watershed creeks, streams and groundwater
    - Decrease fertilizer runoff from residential and golf course areas
    - Protect social, economic, and environmental benefits provided by the bay and watershed
    - Promote public awareness and involvement in estuarine management issues
4. Freshwater Flow
    - Increase and maintain freshwater flow in the Chorro and Los Osos basins
5. Heavy metals and Toxics
    - Reduce the introduction of heavy metals and other toxic pollutants to watershed streams, estuary waters and sediments
6. Loss of Habitat
    - Support and strengthen actions by public agencies and private parties to protect habitat and function
    - Increase the quality and quantity of riparian corridors and estuarine wetland habitats
    - Reduce habitat loss to invasive species
7. Loss of Steelhead
    - Protect and enhance steelhead populations and habitat
8. Public Outreach
    - Increase public awareness of resources, processes and priority problems
    - Increase children's awareness of resources, processes and priority problems
    - Improve cooperative efforts and understanding of issues for partnering agencies, organizations and stakeholders

**Three Year TMDL Implementation Tracking**

The Morro Bay Sediment Total Maximum Daily Load (TMDL) is a progress report describing the status of implementation of as of April 2007. The short term data was inconclusive, and at this time, the staff is uncertain whether sediment water quality conditions are improving. Average turbidity values remain below 10 NTUs at all but the mouth of Los Osos creek, which is tidally influenced. The Staff concludes that TMDL implementation is on track because implementation measures have been moving forward. There are no proposed course corrections at this point.

## 10.5 Appendix E: Policy Survey and Brief – Napa-Sonoma


Permitting

1. Please indicate the Federal and State agencies your group contacted to obtain permissions and permits for your restoration options by marking an "X" in the box to the right of the agency.

| | Federal Agencies | | State Agencies |
|---|---|---|---|
| | US EPA | | Cal EPA |
| X | US Army Corps | | CA Fish and Game |
| X | NMFS | | CA Coastal Conservancy |
| X | US Fish and Wildlife Service | X | CA Water Control Board - SFBAY |
| | US Bureau of Reclamation | | CA Coastal Commission |
| | | | |

Please list other agencies here.

San Francisco Bay Conservation and Development Commission (BCDC)

CA Fish and Game is the landowner and lead CEQA agency, but a DFG permit was not required.

2. Please indicate which permissions/permits your group acquired for your restoration.

__X_ Section 401 Certified Nation Wide Permit
__X_ CWA §404 Permits
___ Section 404 Individual Permit
__X_ Water Quality Certification
__X_ Waste Discharge Permits
___ Department of Fish and Game's Lake and Streambed Alteration Program
___ California Coastal Act: Coastal Development Permit (CZMA)
__X_ BCDC Permit (SF Bay Area only) (CZMA)
___ Rivers and Harbors Act: Section 10 Permit
__X_ Endangered Species Act: Section 7 and 10 Permit
__X_ Other: Please Specify – Section 10 of the River and Harbors Act (Corps)

Note: DFG was the permittee for all permits

3. Please rank your acquired permits based on the level of ease you experienced in receiving the permit. Please rate on a scale of 1 to 10 with 1 being the easiest and 10 being the most difficult.

_4__ Section 401 Certified Nation Wide Permit
_3__ CWA §404 Permits
___ Section 404 Individual Permit
_7__ Water Quality Certification
_7__ Waste discharge Permits
___ Department of Fish and Game's Lake and Streambed Alteration Program
___ California Coastal Act: Coastal Development Permit (CZMA)
__7_ BCDC Permit (SF Bay Area only) (CZMA)
___ Rivers and Harbors Act: Section 10 Permit
_6__ Endangered Species Act: Section 7 and 10 Permit
_2__ Other: Please Specify – Section 10 of the River and Harbors Act (Corps)

4. a. Did your project fall under CEQA guidelines?
_X__ Yes ___ No

b. If yes, explain how the CEQA process affected your project's start and/or progress.

The Conservancy funded consultants to write a joint EIR/S. DFG and the Corps were the lead agencies under CEQA and NEPA. The EIR/S was tied to the Corps's Feasibility Report, which was the major process that affected the schedule and slowed the release of the CEQA/NEPA documents. For the Final EIR/S, we decoupled the documents and released the Final EIR in advance while waiting for Corps HQ to approve the release of the Final Feasibility Report and attached Final EIS.

5. a. Did your project fall under NEPA guidelines?
_X__ Yes ___ No

b. If yes, explain how the NEPA process affected your project's start and/or progress.

See above.

6. How long did it take you to obtain all the necessary permits and permissions for the restoration activities?

The Final EIR and EIS were released in mid and late 2004 respectively and all permits were in hand by July 2005, but we had been working closely with the regulatory agencies since restoration planning began in earnest in 2000. We had meetings scheduled every 3-6 months, supplemented with meetings with specific agencies over the last few years of the project. Regulatory staff were involved in the design of the project.

## Restoration

7. How would you classify the nature of your restoration site?

_X__Mostly Rural ___A mix of Rural and Urban ___Mostly Urban

8. What type of restoration activities did your site undergo? Please check all that apply

___ Large amounts of sediment added
_X__ Changes in tidal prism
_X__ High levels of pollution addressed
___ Movement of major roadways
___ Other: Please describe below

9. a. If large amounts of sediment were added, how much sediment was added?

NA.

b. What was the goal of adding the sediment?

c. How was the sediment obtained?

d. What permits were needed to proceed with this restoration activity?

10. a. If tidal prism change was sought, how did your site achieve this?

In all, 25 internal and external levee breaches, 15 ditch blocks, and several miles of channel excavation and levee lowering occurred in 3 salt ponds totaling 2,900 acres.

b. What permits were needed to proceed with this restoration activity?

All listed above were related to the creation of tidal habitats in former salt ponds.

11. If high levels of pollutants were addressed, please describe how this activity was addressed in your restoration activities.

The ponds had high levels of salt and other water quality issues. Hydrodynamic modeling was conducted to analyze the impacts of breaching the salt pond levees. This issue was of most concern to the SF Bay regional Water Quality Control Board, and was addressed with the timing of the initial breaches during rainy season and the maximum salinity level allowed. We also conducted sediment and water quality monitoring in order to provide the RWQCB with data on what was in the ponds.

12. If major roadways were moved, please describe the permits that were needed to proceed.

NA.

13. a. Please describe the types of permits that were needed to proceed with <u>other</u> restoration activities you indicated in question 7.

The movement of about 500,000 cubic yards of earth around the site for the internal and external levee breaches, ditch blocks, channel excavation, and levee lowering required permits from the RWQCB, BCDC, Corps, NMFS, and FWS.

FWS was also concerned with fringe marsh loss associated with increased tidal prism in the adjacent sloughs. This was addressed by lowering portions of the levees around the salt ponds that were being restored to tidal marsh, resulting in quick replacement of the lost marsh. Overall the project will result in a dramatic increase in tidal marsh, but a short term loss was expected as sloughs scoured.

NMFS was concerned with entrapment of fish in the ponds and with the release of saline water into the sloughs. Design features and timing of water release addressed these issues.

b. What were the principle obstacles you encountered?

In terms of the entire project, the major obstacles included: changing site conditions as the planning and environmental compliance were being conducted, conflicting habitat needs for wildlife (ponds and mudflats = migratory birds; tidal marsh = endangered species), concerns about water and sediment quality in the ponds, differences of opinion among regulatory agencies, landowners, and others about the amount of public access, concerns and unknowns about mercury methylation associated with marsh restoration, annual funding issues for the Corps, and the time involved with several Corps required analyses (incremental cost analysis, real estate, etc.), and the time involved in project review by Corps Division, HQ, and the ASA's office before we could release documents.

14. a. What was the total cost of the restoration?

To date, the cost of construction has totaled about $15m for tidal restoration of 3 ponds along the Napa River totaling 3,000 acres and enhancement, via new water control structures and levee improvements, of 3 ponds totaling 1,700 acres, plus some public access improvements.

Final design for all of the ponds cost about $2m. Planning cost about $6m (cost shared 50/50 between the state and the Corps). Land acquisition was $10m (state acquired the lands in 1994).

Total restoration planning and implementation costs to date are about $23m, plus $10m for land acquisition.

The final design of a recycled water pipeline to aid in bittern disposal from one pond, and the construction of the recycled water pipeline and pond enhancements for 3 remaining ponds, including the pond that contains bittern, are planned in the future. The costs associated with this work is very roughly estimated at $40m. It is anticipated that the Corps will conduct all of this work and the State will be credited for the construction work completed to date. Corps restoration projects are cost shared 35% non-federal and 65% federal. Since the state has already put in $15m, our 35% share has already been contributed to the overall project.

b. How did this compare with the original estimates?

Construction costs have been significantly lower than estimated by the Corps. The Corps estimates conservatively though, as Congress would have to authorize any increases. The total Corps cost estimate for the lands, final design, construction of all of the ponds and the pipeline, construction management, monitoring, and adaptive management is $135m. The state proceeded with construction without the Corps (possibly keeping costs down) because the project has yet to be authorized by Congress in a Water Resources Development Act.

15. Did your restoration efforts seek to slow or reverse the conversion of salt marsh to a more marine environment? If so, what factors most influenced your decision to restore or preserve salt marsh environments? If not, please disregard this question.

No.

16. What advice would you offer to other estuarine managers attempting its first restoration in order to increase the ease and efficacy of restoration efforts?

17. a. Has the progress of the restoration been tracked?
_X__ Yes ___ No
b. If so, has the restoration met its intended expectations and goals? Please explain.

To date, yes, but we are at the beginning of the habitat evolution.

18. Is there anything pertaining to the restoration that you would do differently based on what you know now? Please explain.

The state (Conservancy and DFG) might have chosen to do the project completely on our own without the Corps of Engineers. In the end, the Corps involvement should pay off in terms of federal dollars provided, but it slowed the project planning considerably and added costs to the planning effort. Feasibility Studies should only be conducted with the Corps when the cost of the project is too great for the non-federal agency to bear. The recycled water pipeline would probably not get built without the Corps cost shore, so in the end it was probably worthwhile to partner with them.

## Economic Activities

19. Please indicate the economic activities that are present in the area surrounding the estuary.

___ Power plant operations
___ Harbor operations
_X__ Fishing
_X_ Tourism
_X__ Agriculture
___ Other: Please describe below

## Napa Sonoma Brief

### Background

The San Pablo Bay watershed drains into the northern reaches of San Francisco Bay and is a major drainage basin for Marin, Sonoma, Napa, Solano and Contra Costa Counties, California. The San Pablo Watershed Project addresses near, mid, and long-term restoration and flood protection in the San Pablo Watershed. An estimated 85 percent of the historic tidal marshes in the San Francisco Bay-Delta Estuary have been filled or significantly altered over the past two centuries. The San Pablo Bay's diked baylands provide an opportunity for large-scale restoration of tidal marsh, and over the last decade, state and federal resource and regulatory agencies have purchased a number of properties within thee Napa-Sonoma Marsh Complex, with the intent to restore much of the land to tidal marsh.

The Napa River Salt Marsh Restoration Project includes approximately 10,000 acres of the Napa-Sonoma Marsh Complex. The Napa River Salt Marsh was first diked off from the San Pablo Bay during the 1850s for hay production and cattle grazing. Much of the land was later converted to salt ponds, for salt production by the solar evaporation of bay water. In the 1990s, the Cargill Salt Company ceased the production of salt and sold 9,850 acres of evaporation ponds and associated remnant sloughs and wetlands on the west side of the Napa River to the State of California for $10 million. These ponds and remnant marshes and sloughs are now managed by DFG as the Napa River Unit of the Napa-Sonoma Marshes State Wildlife Area.

**Coastal Conservancy: Napa River Salt marsh Restoration Project Final Design for Phase 2**

The State Coastal Conservancy authorized the execution of a Cost Share Agreement with the U.S. Army Corps of Engineers for the preconstruction engineering and design of the Napa River Salt marsh Restoration. The Conservancy also authorized the disbursement of an amount not to exceed two hundred fifty thousand dollars through the provision cash payments to the Corps, in order to complete tasks identified in the Project Management Plan for Preconstruction Engineering and Design of the project and to satisfy non-federal cost-share requirements.

**Coastal Conservancy: Napa River Salt Marsh Restoration Project**

In this recommendation, the staff authorized disbursement of $187,000 for the development of 90% design documents and permit applications for 5 sites of the Project. This project was also found to be consistent with Chapter 4.5 of Division 21 of the California Public Code regarding the Conservancy' mandate to address the resource and recreation goals of the San Francisco Bay area. The 5 sites account for 1,870 acres of the Project area.

**Napa Salt Marsh Feasibility Report**

This study, prepared with the non-Federal sponsor, the California State Coastal Conservancy and the land owner, the California State Department of Fish and Game, identified a feasible project to restore he former Napa salt pond complex to valuable tidal wetland and pond habitat.

There are three planning objectives:

1. To create a mix of tidal habitat and managed pond habitat to serve a broad range of wildlife, including endangered and threatened species, fish and other aquatic species, and migratory shorebirds and waterfowl.
2. To restore large areas of tidal habitats in a band along the Napa River to maximize benefits to fish and other aquatic animals, and ensure connections between the patches of tidal marsh (within the project site and with adjacent sites) to enable the movement of small mammals, marsh-dependent birds, and fish and aquatic species.

3. To improve the ability to manage water depths and salinity levels in the managed ponds to maximize feeding and resting habitat for migratory and resident waterfowl and shorebirds.

The recommended plan provides a balanced mix of pond and tidal habitat. The plan is considered cost effective and meets the study objectives for creating a mosaic of habitat types with an emphasis on naturally sustainable habitat. The plan includes infrastructure features, primarily water control structures for desalination s well as earth-moving activities associated with the habitat restoration phase of the project. The plan also includes monitoring and adaptive management plans.

The total cost to construct the selected plan, based on April 2004 price levels, would be $55,092,000. Most of these costs would be shared 65% Federal, 35% non-Federal.

**PWA Study: Napa Sonoma Marsh Restoration Feasibility Study Phase 2 Stage 1**
This report documents the first stage of the second phase of the larger hydrology and geomorphology supporting the detailed Feasibility Study. The ultimate objectives of the detailed Feasibility Study are:

- Evaluate a range of salinity reduction measures in the former salt ponds, so that the site can be restored to tidal action with minimal impacts on the surrounding aquatic environment.
- Accomplish restoration of the former salt ponds to "mosaic" of habitats present in the area historically.

The purpose of this study is to undertake initial screening of salinity reduction alternatives. Several conclusions were made:

- Salinity reduction n the lower pond appears feasible.
- Seasonal trends are evident in the numerical results and indicate a strong influence of prevailing meteorological conditions.
- Discharge restrictions have not been identified.
- The precise time frame for pond desalination will depend on prevailing hydrological and meteorological conditions during the project implementation
- Preliminary analyses indicate that salinity reduction in the Lower Ponds may be accomplished within approximately two years.

Sonoma County Water Agency funded further simulations of salinity reduction, and more analysis was needed.

20. Were economic activities you indicated above impacted by the restoration activities? Please explain.

    No, in fact hunting and fishing were improved.

## Stakeholders

21. How did you communicate and negotiate with constituents/stakeholders in your area? Did you formulate a process? Please describe.

We ran Napa-Sonoma Marsh Restoration Group meetings every 3-6 months over the course of the planning process. Regulatory agencies, ngos, and scientific groups attended the meetings. The consultants and lead agencies presented progress. The group is still meeting and is now focused on monitoring in the region and nearby restoration projects. We also conducted 3 public hearings under CEQA/NEPA and got a good turnout of neighbors and interested parties.

22. What was the single most important factor in your final decision to restore, and how was this decision received by your constituents/stakeholders?

The *San Francisco Baylands Habitat Goals Report*, a report prepared by over 100 scientists and resource managers, lays out recommendations for wetland restoration in the bay and clearly calls for tidal restoration of a large number of salt ponds. This combined with the state's investment in the acquisition of the ponds for wetland restoration purposes and the deteriorating conditions of the pond levees and water control structures, were the most important factors. Several stakeholders were concerned about loss of pond habitat for migratory birds, but the project was supported overall. The final plan calls for 50% of the pond land area to be restored to tidal habitats and 50% to remain as managed ponds with enhanced water control structures and improved levees.

23. Is there anything you would change about the stakeholder process you used?

We probably could have reached out to a larger audience. The Napa-Sonoma Marsh Restoration Group consisted of folks involved in restoration work in the Bay Area, and the public meetings were limited to 3 over the course of the project. The project was widely supported though – at the final CEQA/NEPA hearing, the participants applauded the plan. The Napa-Sonoma Marshes are also fairly isolated and remote, which reduces the number of people, organizations, and agencies interested in the details of the project. In the South SF Bay, we are conducting a much larger stakeholder outreach effort, due to the large number of neighbors and interested parties and the adjacency of the project to homes, businesses, infrastructure, etc.