USA: California: Restoring Tidal Wetlands at Sonoma Baylands, San Francisco Bay

Overview

The Sonoma Baylands project recreated tidal wetlands using 2.0 million cubic metres of dredged material. The design was based upon an extensive review of the first generation of restoration projects in San Francisco Bay and incorporated the lessons learned from these early projects. The Baylands project used dredged material in far lower quantities than previous projects to assure that the fill served as a template for the development of a wetland with an extensive tidal slough system. The project design also included a series of peninsulas to break up wind-driven waves and increase sedimentation rates. The target species for the project were the endangered California clapper rail and the salt marsh harvest mouse. The use of dredged material reduced the time needed for habitat development by several decades. Implementing the Sonoma Baylands project required a change in policy for the Army Corps of Engineers. The actual costs of adding the wetland project as part of the large navigation improvement project at the Port of Oakland resulted in about a 5% increase in overall project costs (Marcus 2000).

Quick Facts

Project Location:
Sonoma Baylands, California, USA, 38.1223856, -122.47785929999998

Geographic Region:
North America

Country or Territory:
United States of America

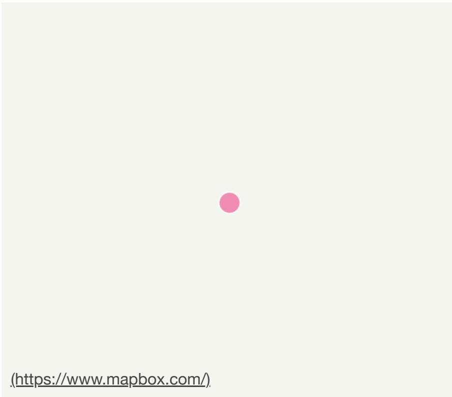
Biome:
Coastal/Marine

Ecosystem:
Estuaries, Marshes & Mangroves

Area being restored:
322 acres acre

Organization Type:
Governmental Body

Location



TIMEFRAME

Project Stage:
Completed

Start Date:
1986-10-08

End Date:
1996-10-08

DEFINING THE PROBLEM

Primary Causes of Degradation

Agriculture & Livestock, Fragmentation, Urbanization, Transportation & Industry

Degradation Description

Over the past 150 years as Europeans and Americans settled in the area, they diked off and filled in nearly 80% of these historic marshes. Tidal marshes were reduced to a mere 10% of their historic acreage. This loss of tidal wetlands caused several endemic species to become endangered, most notably the salt marsh harvest mouse (Reithrodontomys raviventris) and the California clapper rail (Rallus longirostris obsoletus). Over this same time period, populations of migratory shorebirds and waterfowl decreased significantly. The restoration site is an historic tidal wetland, diked and drained around 1900. Two major transportation corridors, a highway and a railroad, cross through the property, separating it into three "˜parcels' (Marcus 2000).

PLANNING AND DESIGN

Reference Ecosystem Description

San Francisco Bay is the largest estuary on the Pacific coast of California. It is the single most valuable area for wintering shorebirds using the Pacific flyway (California State Department of Fish and Game, 1979). Migratory waterfowl also depend heavily on San Francisco Bay. All these birds come to the Bay to feed over the winter. Salt, brackish, and freshwater wetlands once formed a broad ring along the bay shoreline (Marcus 2000).

The concept plan identified relatively low existing wetland values for the three parcels. With the exception of the drainage ditches, there were no wetland plants on the hayfields. Agricultural operations did not allow water to pond and the fields were regularly tilled. Ten years of bird counts for the site recorded large numbers of Brewer's blackbirds, western meadowlarks, and but few shorebirds or waterfowl (Marcus 2000).

Project Goals

Following the acquisition of the property, the first phase of the project was the tidal restoration parcel with a goal of creating endangered species habitat. The "˜tidal parcel' came to be known as the Sonoma Baylands project. The goals of the design were the creation of low cordgrass (Spartina foliosa) marsh for California clapper rail (Rallus longirostris obsoletus) nesting, high pickleweed (Salicornia pacifica) marsh for the salt marsh harvest mouse (Throdontomys raviventris), and intertidal mudflats for migratory shorebirds (Marcus 2000).

Monitoring

The project does not have a monitoring plan.

Stakeholders

Preparation of the concept plan involved a series of meetings with the two primary wildlife agencies, the California Department of Fish and Game (CDFG) and the US Fish and Wildlife Service (USFWS). These two agencies at first disagreed over target wildlife species for the plan. CDFG was most concerned with increasing brackish wetland habitats for migratory waterfowl populations. USFWS was more concerned with recreating tidal habitats for endangered species and migratory shorebirds. The design team for the project included, Laurel Marcus, who worked for the California State Coastal Conservancy at the time, Joan Vilms of the Sonoma Land Trust, Dr Ted Winfield, a wetland ecologist with ENTRIX, Drs. Philip Williams and Joan Florsheim, hydrologists with Philip Williams and Associates, and Rick Olejniczak, the project dredging engineer with Gahagan and Bryant Associates (Marcus 2000).

The Port of Oakland and the Army Corps of Engineers needed an acceptable site to dump dredged material for an essential channel-deepening project that was encountering costly delays and causing controversy. Laurel Marcus began a campaign to create a coalition of allies (e.g., organized labor, business and development, shipping lines, the individual ports, regulatory agencies, congressional and state legislative staff, and environmental groups [especially the Save San Francisco Bay Association, Sierra Club, and Natural Heritage Institute]) strong enough to persuade the Corps to shift away from its traditional policy that would not favor the use of the dredged material for creation of a wetland. Eventually the U.S. Congress played the most direct role by passing legislation directing the Corps to conduct the project with 20 years of follow up monitoring and remediation if necessary. Numerous other agencies and non governmental organizations had a stake in the Sonoma Baylands Project including the EPA, Regional Water Quality Control Board, and San Francisco Bay Conservation and Development Commission (Marcus 2000).

PROJECT ACTIVITIES

Description of Project Activities:
As a part of the purchase of the property, a concept plan was prepared. This plan evaluated the physical features of the site and identified the types of wetlands that could be restored. The goals of the concept plan included having natural processes create the wetland and minimal operation and maintenance requirements. Pumping and manipulating water or other active management schemes were not considered. The entire Sonoma Baylands property encompasses 336 ha and has two major transportation corridors, a highway and a railroad, crossing through the property, separating it into three "˜parcels'. The concept plan documented the conditions on the site, including, elevations for each parcel, the elevations of the culverts in the highway and railroad berms, elevations for the nearby bay wetlands and tidal range, vegetation and wildlife on the site, local rainfall and evaporation data, and the compatibility of current agricultural practices with wetland restoration. The three parcels of the Sonoma Baylands were all roughly 0.6 - 1.2 m below mean sea level enclosed from bay water by levees. As the site was farmed, the organic materials in the wetland soils oxidized and shrank, causing the ground elevations to subside 1.5 - 2.1 m below their original wetland elevations. The culverts that connected the two parcels were set below the 0.0-m NGVD. This elevation restriction combined with a maximum linear distance of 2400 m from a tidal source made tidal restoration of the entire site impractical. The concept plan concluded that only the southern 138-ha parcel could be restored as a natural tidal wetland. The rainfall and evaporation data showed that the other two parcels could be restored as seasonal brackish wetlands. The plan also concluded that the site could remain in agricultural use and open space and fulfill its goals; however, the restoration of wetlands and continued operation of the hayfields were not compatible. Based upon the physical constraints on the site, the concept plan recommended both tidal and brackish marsh, allowing both the state and federal wildlife agencies to endorse the plan (Marcus 2000). The concept plan also identified relatively low existing wetland values for the three parcels. With the exception of the drainage ditches, there were no wetland plants on the hayfields. Agricultural operations did not allow water to pond and the fields were regularly tilled. Ten years of bird counts for the site recorded large numbers of Brewer's blackbirds, western meadowlarks, and house finches, but few shorebirds or waterfowl. The first phase of the project was the tidal restoration parcel with a goal of creating endangered species habitat. The "˜tidal parcel' came to be known as the Sonoma Baylands project. The goals of the design were the creation of low cordgrass (Spartina foliosa) marsh for California clapper rail nesting, high pickleweed (Salicornia pacifica) marsh for the salt marsh harvest mouse, and intertidal mudflats for migratory shorebirds. These wildlife species need complex habitat with slough channels, transitional uplands, and varied patches of marsh types and mudflats as found in a natural system. In San Francisco Bay, pickleweed marsh occurs from a low elevation of +1.8 ft NGVD up to the reach of the highest spring tides, and is dominant at MHHW, +3.5 ft NGVD. Cordgrass marsh occurs from MHW at +2.9 ft NGVD, down to MTL of +0.9 ft NGVD. Intertidal mudflats occur from MTL to MLLW at -2.6 ft NGVD. This complex of varied habitats supplies the greatest wildlife values for the project's target species. There is a natural process of sediment movement and accretion that transforms mudflats into low marsh and then into high marsh. The design of the Sonoma Baylands project incorporated recognition that natural processes create and evolve these habitats. The design focused on the physical processes affecting the site that would form, create, and evolve the wetland habitats and evaluated what construction was needed on the site to assist natural tidal processes in creating these habitats. One aspect of the design was the use of dredged mud to increase base elevations on the site to speed up the development of intertidal areas (Marcus 2000). A primary component guiding the design was review and monitoring of other restoration projects. Two of these "˜first-generation' projects at Muzzi Marsh and Salt Pond Three used dredged material as fill and were resurveyed to evaluate how they had evolved since their construction in the mid 1970s. Several other sites, the Dickson Property, Warm Springs Marsh, and Toy Property, did not use fill but were evaluated for their development following restoration. The first-generation projects that used dredge material were evaluated. The approach used in these early projects was to fill the site to the MHHW elevation, the ultimate level of the mature marsh plain. The cover and diversity of plant species in relation to elevation and the density of tidal channels that had developed at various elevations in the site were evaluated several decades after restoration. Slough channel density was measured as the total length of channels (in miles) per square mile of marsh. A natural marsh at the Corte Madera Ecological Reserve had a density of 53.4 miles (89 km) of channels per square mile of marsh. The Salt Pond Three site covers 40 ha of former salt evaporation ponds filled by the Corps of Engineers in 1974. When surveyed in 1988, the upper portion of the site was 1.7 ft above MHHW and had a low density of drainage channels of 8.6 miles per square mile of marsh. The upper area only supported pickleweed. The lower portion of the site had a higher density of

channels at 20.8 miles per square mile of marsh and was at an elevation of MHHW. It also supported only pickleweed. Just after restoration, this lower area had supported cordgrass, but the site had rapidly filled in and was dominated by pickleweed. Muzzi Marsh is a 135-acre site restored in 1976. Dredged mud was placed on 26 ha of the site and spilled over into the other portion. The filled area had a channel density of 29 miles per square mile and was at an elevation of +3.4 ft NGVD or about MHHW. This area was largely pickleweed marsh. The lower area had a channel density of 68.6 miles per square mile of marsh and was at an elevation of 2.3 ft NGVD, or about MHW. The lower area had a diverse habitat of channels, cordgrass, and mudflats. It supported clapper rails as well as shorebirds. The Toy Property, Warm Springs Marsh, and Dickson Property were evaluated for the effect of wind and waves on shoreline erosion, sedimentation rates, and development of the tidal plain. These sites, all diked historic baylands, were flooded with tidal water through the breach of a levee and connection to the bay. All three sites had subsided and when tidal flows were restored, they had large areas of open water subject to strong summer and winter winds. These sites showed several problems derived from wind driven waves including erosion of the perimeter levee requiring expensive repair and a lack of sediment build-up. Sediment is brought into the site with the tide, but does not build up if continuously resuspended by wind-driven waves and transported out. The analysis also evaluated the relationship between the size of the connecting tidal breach on tidal flow volumes and marsh development. From this review, the design team formulated several conclusions, 1. Filling the site to create a finished tidal marsh at an elevation of 3.5 ft NGVD results in inadequate development of tidal channels, the circulatory system for the wetland. Development of an adequate channel system is necessary to achieve a fully functional wetland with diverse habitats. Projects that were filled to a lower elevation of +2.0 ft NGVD allowed for the development of an extensive slough channel system and biologically diverse wetland. 2. A construction element was needed to address the wind-driven waves in tidal restoration projects. The structure would break up waves, still tidal water, and increase sediment deposition during the first decade of the opening of the site. The structures should be arranged on the site to reduce wind fetch distances below 300 m. 3. For most of the sites, a stretch of mudflat and marsh separates the restoration site from the deeper areas of the bay. The size of the breach and channel is important for gaining development of full tidal exchange in the restoration site. The opening of the new tidal basin needs to be deeply excavated to remove the compacted material of the old original levee. One of the sites reviewed had a sill of compacted material that was not removed and thus restricted full tidal exchange. The breach should be sized to accommodate the estimated tidal prism for the restored site. The outer entrance channel would scour over time and adjust to this new "˜back bay' tidal flow if the breach was large enough. 4. Using dredged mud to create an intertidal template could accelerate restoration of tidal marsh habitats. However, to develop and evolve an adequate channel system, the template elevation should not exceed 0.6 m NGVD. With these recommendations, the design for the Sonoma Baylands site was completed in 1991. The design consisted of several elements: 1. Construction of a new flood control levee with a crest elevation of +12 ft NGVD to accommodate the 100-year high tide storm surge event. The wetland side of the levee would have a 5:1 slope. The levee would protect adjacent low-lying lands and freeways from tidal inundation. A set of high voltage transmission towers would be enclosed in the new levee system as well. 2. Construction of a series of wave breaker peninsulas. These peninsulas were oriented to disperse summertime wave patterns. The arrangement of the peninsulas was determined after careful study of local patterns of wind speed and direction. The peninsulas would protect the levee from erosion and increase the sedimentation rates in the perimeter areas of the site. This feature would assist in the development of high marsh along the site perimeter. In the middle of the site closest to the entrance channel, there would be no peninsulas, to allow for greater wind scour and accommodate cordgrass habitat for a longer time. The peninsulas would only be needed for the first decade of the wetland development, when the site was largely open water at high tide. As the site filled in with natural sedimentation, elevations would increase. Vegetation would invade and break up the waves. The peninsulas would be built to the +4.0 ft NGVD elevation and would subside to the elevation of high marsh over time. 3. Placement of up to 2.5 million m3 of clean dredged mud from one of several local dredging projects to create a template at the +2.0 ft NGVD elevation. The levees and peninsulas were also located for facilitating the placement of dredged material. It was preferable to place all of the material in one construction cycle rather than small amounts over many years of construction. For this reason, only large channel deepening projects were reviewed as potential sources of material. The material would be kept wet the entire time it was on site to avoid oxidation and changes in pH. Using the dredged material would decrease the time for developing the marsh habitats by 20 - 40 years over natural sedimentation rates. Natural sedimentation rates for this area of the bay were calculated from measurements for a nearby marina. 4. Tidal flows would be restored by connecting to a natural outboard tidal slough channel. The tidal prism of the restored site would erode the entrance channel to a wider and deeper size over time. Natural erosion was preferable to dredging the entrance channel. 5. Monitoring needed to be a part of the project. A "˜pilot' project of 16 ha isolated within the site by a utility levee was proposed to evaluate surveying, placement, and monitoring methods for the dredged material. The mud is hydraulically placed in slurry of up to 80% water. Special instruments are needed to determine when the maximum fill elevation of +2.0 ft. NGVD is achieved. Overfilling does not benefit the restoration project. A long-term monitoring program for the physical and biological performance of the site was also proposed. With the design completed and the project parameters set, the project needed institutional funding and political support for implementation (Marcus 2000). Implementing the project (Marcus 2000): As part of the design process, a restoration project that used dredge material and one that did not were both evaluated. Since the use of fill would accelerate the development of marsh habitats for the endangered species by several decades, this alternative was pursued. Sources of dredge material were evaluated according to the amount of material the project needed to achieve its ecological goals. Dredging controversy in the bay - During the 1980s, the Port of Oakland was in the midst of a battle with many interest groups over proposed sites for disposal of some 6.6 million m3 of clean dredged mud. Until acceptable sites were found, the Port could not proceed with an essential channel-deepening project to accommodate larger ships. As the debate over dredging wore on, shipping lines began to use other ports, and Oakland's share of the maritime market dwindled. The Corps of Engineers, which is primarily responsible for dredging in navigable waters, had proposed to dump the mud back into the Bay near Alcatraz Island. It had also proposed disposal in the nearshore ocean, near Half Moon Bay. Both proposals had evoked angry opposition from commercial and sport fishermen, environmentalists, and even bay swimmers. The Half Moon Bay Fishermen's Association won a court battle to protect its productive fishing grounds. By 1989, all sides in the conflict were embittered and angry, and no solution was in sight. Even before the design plan for the Baylands was completed, the Corps and the Port of Oakland began to inquire about the project and the concept of using dredged materials to restore a marsh. The design had concluded that the Baylands could use 2.0 - 2.5 million m3 of dredged mud. The exact quantity would depend upon the ratio of sands, which were larger and took up more room, to the smaller silts and clays. This amount of material was significant; the Baylands project could take over a third of the mud that was to be dredged from the Port of Oakland. Cost estimates for the placement of the fill were encouraging, showing that barging mud 42 km from the Port of Oakland to the Baylands site would be cost-competitive with barging mud to the most recently proposed deep ocean disposal site 70 miles offshore. The primary environmental issue remaining was to assure that all the material placed at the Baylands was clean and passed the rigorous ocean disposal testing. The environmental protection agency (EPA) and the San Francisco Bay Regional Water Quality Control Board oversee testing programs, assure the validity of test results, and determine the suitability of dredged materials for disposal. They base their conclusions on the results of chemical testing and the results of bioassay tests, which evaluate the toxicity of water and sediment from the dredged materials to various species of zooplankton. Only dredged material deemed suitable for aquatic disposal would be allowed at the Baylands. In addition, to make sure that chemicals from Oakland's material did not bioaccumulate in wetland plants and animals, the Corps grew these 380 plants and animals in the sediments for a year in a laboratory. Results of these tests showed no significant uptake and concentration of persistent chemicals, even for dredged materials that were not considered suitable for ocean disposal. These tests assured us that we would not be creating a problem that would appear many years from now. As a matter of fact, much of the dredged material was cleaner than the samples tested from the existing natural marshes near the Baylands site. Legislative success - At a meeting in 1991 for all concerned elected officials, government entities, special interest groups, and the ports, Lauren Marcus presented the Baylands design and how to implement the project as a part of a dredging project. The response was surprising. The Bay Area Congressional delegation, federal and state regulatory agencies, environmental groups, and port authorities expressed support; the Corps of Engineers, however, was not encouraging and reminded everyone that it lacked specific congressional authorization to undertake the Baylands project. At this time, Corps policy did not favor wetland creation as an option for disposal of dredged mud. Bound by a tradition of aquatic disposal and a national policy to implement the cheapest alternative, the Corps was committed to a different philosophy. At this point, L. Marcus began a campaign to create a coalition of allies strong enough to persuade the Corps to shift away from its traditional policy. All parties who held an interest in dredging including organized labor, business and development, shipping lines, the individual ports, regulatory agencies, as well as congressional and state legislative staff were briefed. The goal was to convince them that the Baylands project was the key to resolve the dredging impasse and that their assistance was crucial. The overwhelming support for the project by environmental groups, especially the Save San Francisco Bay Association, Sierra Club, and Natural Heritage Institute, was a clear bargaining chip. These groups had successfully stopped the port of Oakland in its previous attempts at dredging and had steadfastly opposed aquatic disposal. The Port of Oakland cautiously endorsed the Baylands, unsure of how much it might cost, but very willing to help get its dredging project moving. Many different parties came to see the Baylands not just as a good compromise to get the port dredged, but as a good idea for reusing dredged material. Still, it would take an act of Congress to have the project implemented. In 1992, the bay dredging action coalition (BDAC), newly formed by community, business, and labor leaders to resolve the dredging crisis, made the Baylands a cornerstone of its political agenda. The coalition's letterhead listed shipping lines, banks, chambers of commerce, numerous trade unions, and others with an interest in seeing the Port of Oakland channel deepening proceed. The project now had the broad-based backing it needed. While environmental groups supported the project, it was largely this powerful coalition that pushed the Baylands through the system, helping the Bay Area Congressional delegation. In the 1992 Water Resources Development Act, Congress directed the Corps to build the Baylands project. Specifically, it instructed the Corps to complete final engineering designs, build the first stage of the project, including the levee and peninsulas, and place clean dredged material on the site for the purpose of restoring a wetland. The Congressional authorization also included a 20-year monitoring program and remediation of physical functions of the wetland if needed. In 1993, a major push was made to get the Corps begin the work authorized by Congress and have the Baylands ready on the same schedule as the Port of Oakland channel deepening project. The Corps agreed to proceed with the next steps in the process. Permitting problems and policy dilemmas - Just as the Corps had endorsed the project, a federal agency with responsibility for the protection and recovery of endangered species responded to the Baylands with a negative letter and recommended that the project permits be denied. The USFWS requested a number of additions to the project, the most controversial of which introduced the assumption that tidal marsh restoration required mitigation. Specifically, the Baylands hayfield retained low spots that ponded water in very wet years and thus created "˜seasonal' wetlands. The Corps had determined that 23 ha of Section 404 jurisdictional wetlands existed on the site. The Corps and the other agencies involved had agreed that a fully tidal 138-ha wetland would provide such high value habitat that it would more than compensate for the loss of these occasionally ponded hayfields. But USFWS recommended that several hundred acres of seasonal wetlands be created as mitigation for restoration of the tidal wetlands. This was an expensive condition to accommodate, and it set a precedent that could eliminate other future restoration projects. Perhaps the most difficult part of this request was its timing. The USFWS had participated in the Baylands project for four years and had contributed to both the concept and the specific design. Why did it only now bring up such a fundamental issue? The other agencies, the EPA, the Regional Water Quality Control Board, the San Francisco Bay Conservation and Development Commission, the California Department of Fish and Game, and even the Corps, stood firmly in opposition to the Service's contention that tidal restoration projects required mitigation. Environmental groups, however, were split into two camps by this new requirement. On one side were those who had fought ocean and bay dumping and saw the Baylands as an environmentally beneficial answer to the dredging dilemma. On the other were people passionately concerned about seasonal wetlands, fearful of future restoration projects. After many emotionally charged months of debate, a compromise was reached. Ten hectares of seasonally ponded area was added to the Baylands site. The area between the new levee and the old drainage ditch would be compacted and managed as a high-quality seasonal wetland. The other parcels of the site would also be restored to add to the seasonal wetland acreage. These concessions would not become permit conditions and therefore would not set a policy precedent for requiring mitigation for other wetland restoration projects. Finally, USFWS withdrew their opposition to the project. Economics and cost-sharing on the project was another subject of lengthy negotiation. Under the Corps system, the national economic development (NED) alternative, determines the cost-sharing on a project. In the case of the port's project, the Corps had determined that ocean disposal was the cheapest alternative, despite the distance of 120 km from the offshore site. The Baylands project was required to cost share 25% of the $1.5 million in site-improvement costs for the levee, peninsulas, and utility line changes. The Baylands was also required to cost share the "˜"˜difference'' between the cost of bringing dredged material to this site and the cost of ocean disposal. This difference was estimated at $3.4 million. Overall the total cost for the Baylands including land acquisition and design was about $6 million, roughly a 5% increase in the overall $100 million estimate for the dredging project. Presidential endorsement for the project - In December 1993, President Clinton endorsed the Baylands project as a part of the Port of Oakland dredging effort. In the wake of large-scale military base closings, the Port of Oakland was seen as especially vital to the local economy. A White House task force was created to speed the Port dredging and the Baylands projects along. The negotiation of funding and cost share agreements and completion of all the plans and specifications for the project progressed quickly. Throughout all these stages, the ecological goals of the project were preserved; no additional filling or significant changes to the design were allowed. Construction begins - Construction of the levee and peninsulas began in July 1994, following a dedication ceremony with Vice President Gore. The construction required 2 months. Dredging and placement operations from the Petaluma River channel began in September 1994 and filled the 40-acre pilot project. This operation used resistivity probes to monitor slurry density and control the fill amounts and elevations. Dredging the river channel deepened the landing site for the barges from Oakland, allowing them to be filled with greater volumes of material and reducing unit costs while allowing the testing of the probes. The pilot unit was opened to tidal action in January 1996 after the material had consolidated. Placement of Oakland material began in May 1995 and proceeded smoothly. The resistivity probes worked well at determining fill elevations. Returning water from the site met all water quality requirements. The location of the probes and engineering specifications broke the site into cells where fill amounts were measured. This approach clearly retained the maximum fill elevations and protected the ecological integrity of the project. The main unit of the site was allowed to consolidate for months while the final monitoring plan was being completed. Tidal flow was restored to the site in October 1996. Monitoring - Monitoring of the physical and biological aspects of the site began before opening the sites and will continue for the next 20 years.

PROJECT OUTCOMES

Ecological Outcomes Achieved

Eliminate existing threats to the ecosystem:

Both units were opened to the tidal action of the Bay in 1996, beginning the process of natural marsh formation. The Sonoma Baylands project began attracting large numbers of shorebirds and waterfowl even before the restoration of tidal action. Marcus (2000) reported shorebird use was already very high and cordgrass and pickleweed had established at the site through natural colonization. The tidal channels that connect the project to the open waters of the Bay have gradually expanded, increasing the range of tidal action and the amount of sediment deposition in the restoration area. Salt marsh vegetation quickly colonized the entire perimeter of the restoration area and is gradually expanding further toward the center of the site as additional sediment is naturally deposited over the dredged material. The site continues to provide a feeding and resting area for large numbers of shorebirds and waterfowl as development of the young marsh continues to progress (CCA 2008).

Factors limiting recovery of the ecosystem:

Two major transportation corridors, a highway and a railroad, cross through the property, separating it into three "˜parcels' (Marcus 2000).

Socio-Economic & Community Outcomes Achieved

Economic vitality and local livelihoods:

The Sonoma Baylands Project allowed for the easing of a dredging controversy in the bay providing a direct economic benefit as the use of the Port of Oakland had been dwindling. An additional benefit accrued by creating a 300-acre tidal wetland with significant environmental value (Marcus 2000). Passive recreation values also have stemmed from the project with a later trail project aiming to enhance such opportunities while also conserving wildlife habitat (Gandesbery 2003).

KEY LESSONS LEARNED

Key Lessons Learned

The Sonoma Baylands is more than just a tidal restoration project or a creative answer to a port's dredging problem. It represents an ideal case “” the transformation of a situation in which animosity and conflict dominate to a peaceful and beneficial settlement “”backed by a successful political coalition. In California, where divisions are often stronger than alliances, the Baylands is a unique victory, demonstrating the ability of people with diverse viewpoints to agree, cooperate, and accomplish great things together. It is also important to note that the Baylands began not as a government-mandated program or policy directive, but as the vision of several people. It became a reality through the hard work of many people in government and private organizations, all of whom were ready to embrace a new and useful idea and to combine efforts to achieve its implementation. The Baylands project was always managed as a collaborative effort with many supporters (Marcus 2000).

The Baylands is also a fine example of integrating the knowledge from past restoration efforts to create a new and better-informed approach. Once defined, the ecological goals were retained in all aspects of the project from design and engineering to construction and monitoring. At no time did the project change from marsh restoration to dredged material disposal. The inclusion of a large-scale marsh restoration in an industrial port dredging project has opened the door for other similar projects nationwide. When evaluated only as a dredged material disposal site, the Baylands costs slightly more (5%) than disposal at the newly designated ocean site 70 miles offshore. However, this economic evaluation does not account for the value of creating a 300-acre tidal wetland. When the value of the habitat is included, the Baylands was the clear bargain compared to aquatic disposal, which produces no environmental benefits (Marcus 2000). The success of the Sonoma Baylands project has provided the basis for a continuing and productive partnership between the California State Coastal Conservancy and the U.S. Army Corps of Engineers. The Conservancy, Corps and cooperating stakeholders are currently pursuing several other larger restoration projects in San Francisco Bay (CCA 2008).

Largely in response to the Baylands project, the long-term management strategy (LTMS), a multiagency planning effort for disposal of material dredged from San Francisco Bay, includes wetland creation as a regulatory alternative. The LTMS agencies, the EPA, the Regional Water Quality Control Board, the Corps, and the San Francisco Bay Conservation and Development Commission, have all endorsed the concept of reuse of dredged material. The LTMS proposes to set a policy that 40% of all dredged material in the bay go to sites such as the Baylands. It is important to note that the Sonoma Baylands was first and foremost a wetland restoration development project. Its planning, design, and construction followed ecological goals established without reference to dredging projects or fulfilling policy concepts. The decision to use dredged material at the Baylands was made after a thorough evaluation of the site and the potential benefits of using fill to accelerate wetland development. Not all restoration sites will necessarily benefit from using dredged material. The Baylands project was realized through the collaboration of many parties. The LTMS proposal seeks to regulate the dredging community to institute Baylands-like solutions. There is a fundamental difference in approach between a collaborative development and a regulatory directive. A collaborative approach is far more likely to be successful. The LTMS agencies in implementing their policy directives need to establish sound ecological goals for restoration, and a collaborative approach with the maritime industry and ports (Marcus 2000).

LONG-TERM MANAGEMENT

Long-Term Management

The Corps was directed in the 1992 legislation to complete long-term monitoring (20 years) and remediation of physical functions of the wetland if needed. The Corps and Coastal Conservancy are continuing to closely monitor the development of the marsh (CCA 2008). Physical change, such as the erosion of the outboard entrance channel, development of tidal range, development of channel morphology, colonization by vegetation, and use by bird, fish and invertebrate species, is being recorded (Marcus 2000).

FUNDING

Sources and Amounts of Funding

about $6 million USD Economics and cost-sharing on the project was another subject of lengthy negotiation. Under the Corps system, the national economic development (NED) alternative, determines the cost-sharing on a project. In the case of the port's project, the Corps had determined that ocean disposal was the cheapest alternative, despite the distance of 120 km from the offshore site. The Baylands project was required to cost share 25% of the $1.5 million in site-improvement costs for the levee, peninsulas, and utility line changes. The Baylands was also required to cost share the "˜"˜difference" between the cost of bringing dredged material to this site and the cost of ocean disposal. This difference was estimated at $3.4 million. Overall the total cost for the Baylands including land acquisition and design was about $6 million, roughly a 5% increase in the overall $100 million estimate for the dredging project.

LEARN MORE

Other Resources

Peer reviewed: Marcus, L. 2000. Restoring tidal wetlands at Sonoma Baylands, San Francisco Bay, California. Ecological Engineering. 15:373-383.

Not peer reviewed: Cooperative Conservation America (CCA). 2008. Sonoma Baylands Wetland Demonstration Project – Turning a Quagmire into a Marsh. http://www.cooperativeconservationamerica.org/viewproject.asp?pid=334

Gandesbery, 2003. Sonoma Baylands Public Access – Staff Recommendation. Coastal Conservancy, File No. 88-024.

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