

Managed Shoreline Retreat and Dam Removal: Ecosystem Restoration to Benefit Coastal Resources

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Abstract

Human impacts to coastal watersheds in Southern California result in long-term degradation of coastal resources. This is especially evident in two areas: the loss of recreational beaches due to beach erosion and the endangered status of native anadromous fisheries. This paper presents beach and watershed restoration efforts currently underway in Ventura County that may serve as a case study for progressive management measures leading to long-term coastal management solutions.

One of the findings of California's 1997 Ocean Agenda was the need for enhanced shoreline management to address coastal erosion. Since 1995, the City of Ventura has taken the lead role in a planning process aimed at a "Managed Shoreline Retreat" at Surfers Point. The intent is to relocate a damaged bike path and parking lot in order to restore the shoreline adjacent to the mouth of the Ventura River to provide a natural sand and cobble buffer zone.

Concurrently, a feasibility study is underway for ecosystem restoration related to the obsolete Matilija Dam 16 miles up the Ventura River. The objective is to restore natural watershed processes to renew the natural coastal sediment supplies and to provide fish passage to the historical spawning streams of the federally endangered southern steelhead trout.

The lessons learned from these two projects will serve as a case study for watershed-based ecosystem restoration to benefit coastal resources.

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Introduction

Studies have determined that approximately 85 percent of the California coast is actively eroding. This has become a serious problem, threatening public and private properties, recreational opportunities, and the economies of coastal communities. (DBW 2002)

Regional erosion problems typically lead to local responses. Individual property owners construct seawalls and other shore protection structures, the result being the progressive hardening of the California coastline. By 1990, 130 miles, or 12 percent of the coastline was armored, a 500 percent increase since 1971. (Griggs 1998) While these structures serve to protect coastal properties in the near-term, the long-term result has been the narrowing and loss of public beaches statewide.

In recent years, much has been learned about the cause and effect processes leading to the erosion of ocean beaches, with considerable attention been centered on solutions to this problem. State policy focuses on both local and regional solutions to the coastal erosion problem. This policy places the local priority on relocating threatened infrastructure and/or using artificial beach nourishment as an alternative to shoreline armoring.

Regionally, the reestablishment of sediment supply is seen as the long-term solution to a sediment-starved shoreline; the root cause of coastal erosion. However, this strategy has far-reaching ecological implications. Specifically, it broadens the scope of shoreline restoration to include coastal watersheds, which have been severely impacted by dams and other development. A measure of the decline of these ecosystems is the near-extinction of the southern steelhead trout, which is often considered an indicator species for California's coastal resources.

This paper presents current efforts in Ventura County to demonstrate long-term solutions for the restoration of California's coastal resources. The "managed shoreline retreat" project at Surfers Point serves as an example of a local initiative employing innovative methods to solve coastal erosion. Similarly, the removal of the obsolete Matilija Dam serves as a case study for watershed restoration to benefit coastal resources.

Background

Over the past century, human impacts on the shoreline and watersheds of Southern California have resulted in the long-term degradation of coastal resources. Intense coastal development and urbanization, combined with dams and flood control measures within coastal watersheds have caused significant beach erosion and continued loss of wildlife habitat. In the past decade, the critical state of California's coast has spurred investigation and recognition of the cause and effect relationships

affecting these resources. The result has been enhanced public policy. In addition, funding has been provided for much-needed programs that will eventually lead to the design and implementation of restoration projects.

Public Policy on Coastal Erosion. Coastal erosion is a matter of growing concern among the public and government agencies. The state's world-renowned beaches are progressively diminishing as a result of the long-term effects of coastal development and watershed changes. As evidenced in the proliferation of seawalls in California in the past century, the reduction in sediment supply along a developed shoreline inevitably leads to coastal armoring and loss of the recreational beaches.

In 1997, the Resources Agency of California published *California's Ocean Resources: An Agenda for the Future (Ocean Agenda)* (Resources Agency 1997). This document offered the following recommendations:

Recommendation C-1. Update and revise the State's 1978 policy guidance document regarding shoreline erosion and maintenance.

Recommendation C-2. Develop planning and regulatory procedures for coastal project applications or regional initiatives concerning shoreline erosion and its management which more efficiently utilizes existing State agency data and expertise.

The *Ocean Agenda* also included recognition of the need for “a comprehensive long-term maintenance approach for conserving, enhancing and protecting California beaches”, and the growing need for coordination between local, state, and federal government.

These recommendations soon led to the Public Beach Restoration Program, created in 1999 by Assembly Bill 64 (Public Beach Restoration Act; Harbors and Navigation Code, sections 69.5-69.9), which provided \$10 million for grants to be administered by the California Department of Boating and Waterways (DBW) in fiscal year 2000-01.

In 2001, the California Resources Agency published the *Draft Policy on Coastal Erosion Response* (Resources Agency 2001), as a model for state agencies addressing shoreline erosion in California. This policy states that:

In cases where existing development is threatened, a first priority should be to evaluate the feasibility of relocating such development. A second priority should be to evaluate the use of beach nourishment, if it is feasible and can be used effectively, without significant effects on the environment, to reduce the threat or risk of erosion to existing development.

In response to the growing need for quantitative information, the Public Beach Restoration Program funded the *California Beach Restoration Study* (DBW 2002).

This report documents the economic value of the California's beaches and the chronic loss of recreational beaches to beach erosion. Chapter 7 of the report provides an analysis of the reduction of fluvial sediment supplies due to dams and debris basins throughout the state. The report states:

In Southern California, (Point Conception to San Diego), sediment supply to the coast has been reduced by over 50% to half of the littoral cells; in the other half, reductions range from 26% to 49%. The greatest decrease in fluvial sediment delivery has occurred in the areas with the greatest demand for recreational beaches.

This report concludes that:

To protect and restore this economic resource, the Department of Boating and Waterways has estimated that the State of California needs to invest \$120 million in one-time beach nourishment costs and \$27 million in annual beach maintenance costs.

However, it also recommends regional approaches to the statewide beach erosion problem, including the removal of obsolete dams:

Substantial increases in sand volume to local sediment budgets, resulting in wider beaches, could be realized by removing those dams that are no longer serving any useful function, and bypassing sediment around those that are functional but impound significant volumes of sand.

Public Policy on Anadromous Fisheries. Another coastal resource of critical importance is the decline in anadromous fish; species that migrate from coastal streams and rivers to the ocean, returning to their stream of origin to spawn. While the Pacific Northwest struggles to maintain their salmon fisheries, the historic runs of steelhead trout in Southern California have all but disappeared. These native anadromous fish once returned to coastal streams and rivers by the thousands. The primary limiting factor for this species are dams that have blocked access to ancestral spawning streams found in the upper watershed areas.

In February 1996 the California Department of Fish and Game (DFG) authorized the *Steelhead Restoration and Management Plan for California*, (McEwan and Jackson 1996) which states:

Restoration of California's anadromous fish populations is mandated by The Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988 (SB 2261) which states that it is a policy of the State to significantly increase the natural production of salmon and steelhead by the end of the century. SB 2261 directs the Department to develop a program that strives to double naturally spawning anadromous fish populations by the year 2000.

Furthermore, the *Steelhead Restoration and Management Plan* calls for:

Restoration of access to historical spawning and rearing areas through barrier modification, fishway installation, or other means.

The *Ocean Agenda* recognized the fisheries problem, and stated:

Recommendation A-4. Establish additional comprehensive long-term approaches for sustainably managing California's ocean and coastal fishery stocks, with an emphasis on re-building stocks in decline.

In 1997, the southern steelhead trout was added to the federal list of endangered species. The *Endangered Species Act* requires that recovery actions be taken to achieve the goal of de-listing the species. (Finney & Edmondson, 2001) As a result, the fisheries issue has been the driving force behind many of the existing watershed-based planning and restoration efforts in the state.



Figure 1: Ventura River delta, November 1999.

The Ventura River Watershed – a case study

Current planning efforts to restore the coastal resources associated with the Ventura River watershed are notable as potential long-term solutions to the degradation of coastal resources. Beach erosion near the mouth of the river at Surfers Point has resulted from inadequate coastal management combined with long-term watershed influences. These same watershed changes have led to the endangered status of the anadromous southern steelhead trout.

Beach Erosion at the Ventura River Mouth. The mouth of the Ventura River is characterized by one of the largest intertidal cobble fields in Southern California. (Ferren 1990). This geological formation is also responsible for the natural “point break” surfing wave that provides surfers with consistent conditions from varied swell directions. The aerial photo of Figure 1 shows how a strong west swell refracts over the cobble delta forming a world-class surfing wave. Studies indicate that over the past half century, the river delta has experienced an average shoreline recession of approximately 1.5 feet per year. Overlying this recession, episodic floods associated with El Nino events introduce large pulses of sediment that temporarily widen the beaches near the river mouth before littoral transport redistributes this material down coast. (Noble 2000)

According to the 1997 *Coastal Agenda*:

Infrastructure to support ocean and coastal tourism and recreation, such as parking facilities and public transportation, restrooms, and formal trails, are in many cases in need of expansion, greater maintenance, and repair.

Recommendation G-2. Identify public infrastructure along the California coastline in greatest need of maintenance, repair or protection from additional tourism and recreational activities, and prioritize necessary actions.

Statewide, this infrastructure has in many cases been damaged by coastal erosion, often as a result of poor coastal planning leading to inadequate setbacks from a dynamic shoreline. Because one of the primary mandates of the California Coastal Act is to provide for public access, concessions are often made to provide public infrastructure without full consideration of the long-term impacts to placing such facilities in a hazard-prone area. The situation near the mouth of the Ventura River is certainly an example of this.



Figure 2: Construction of the Surfers Point parking lot and bike path, 1989.

In 1989, a bike path and parking lot were constructed on artificial fill placed adjacent to the beach. As Figure 2 shows, these facilities were placed within the oceanfront corridor at Surfers Point and encroached upon a remnant dune formation. The increased public access soon led to the destruction of the dune resource. (Capelli 1991) This development was approved through an amendment to the *Local Coastal Plan* (LCP) in order to provide for “public uses and development, including a public roadway, walkways, bikeways, parking and other infrastructure incident to public access and recreation” within the 250-foot setback designated as the “oceanfront corridor.” (City of San Buenaventura 1989) This policy adjustment to accommodate the new development compromised the intent of the previously designated setback, and is the primary cause of the problems that followed.



Figure 3: Parking lot and bike path near the mouth of the Ventura River, 1995.

By 1992, only two storm seasons after construction, ocean waves had damaged the new bike path. The City of Ventura applied for a coastal permit to construct an emergency revetment to armor the shoreline and protect the bike path. The permit was denied, but rocks were subsequently placed on the beach. State and federal regulatory action ensued, but the matter was settled under the provision that a plan be developed within 18 months. Unfortunately, disagreement among the various state and local government agencies and local stakeholders stalled the process, and this “emergency” coastal structure remains in place a decade later. The aerial photo in Figure 3 shows how this structure exacerbated the erosion problem, resulting in increased loss of the parking lot.

“Managed Retreat”. Since 1995, the City of Ventura has taken the lead role in a planning process aimed at a “Managed Shoreline Retreat” at Surfers Point. The “Surfers Point Working Group” includes representatives from the City of Ventura, the Surfrider Foundation, and several state agencies: Coastal Commission, Coastal Conservancy, State Parks, Seaside Park/31st Agricultural District, State Senator O’Connell, and State Assembly Member Jackson.

Following years of negotiation, the working group agreed upon a plan for “managed shoreline retreat.” The intent is to relocate the damaged bike path and parking lot, and restore the shoreline to provide a natural sand and cobble buffer zone. In October 2002 the working group agreed upon a preferred alternative, and a draft EIR was released late in 2002. The preferred alternative originated from suggestions made by the Surfrider Foundation, and provides for the restoration of the 65-foot retreat zone to a more natural beach environment. As shown in Figure 4, all artificial fill beneath the parking lot will be excavated and replaced with beach quality cobble and sand. The design includes rebuilding the backshore to provide a dynamic cobble buffer zone rather than a concrete seawall. The plan also provides for dunes planted with native vegetation, and fenced walkways to provide controlled public access to the beach. An additional opportunity provided by this project will be the construction of a drainage system for the fairgrounds property, which currently pumps unfiltered stormwater directly into the estuary and onto the beach.

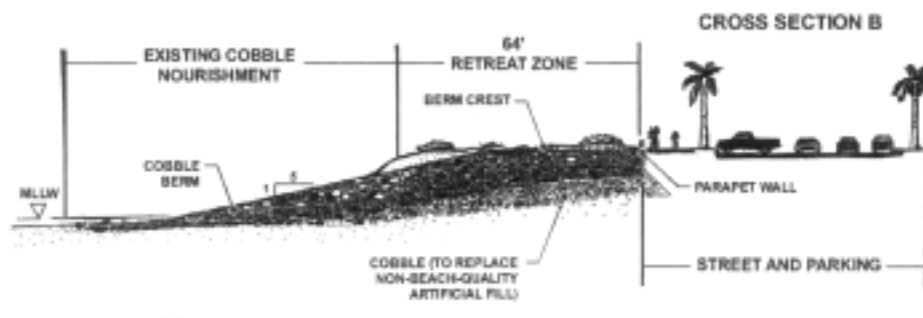


Figure 4: Plan for “Managed Shoreline Retreat at Surfers Point, Ventura

The Surfers Point Managed Shoreline Retreat project provides a clear opportunity for the restoration of a popular and heavily used recreational resource in a semi-urbanized setting. The more natural cobble shore protection solution serves as an alternative to shoreline armoring. Indeed, in this situation a concrete or rip-rap seawall would not be consistent with state and local coastal policy. Shoreline retreat will provide a clear demonstration of the intent of the *Draft Policy on Coastal Erosion Response*, and serve as an example of innovative shoreline management to preserve California’s public beaches.

Impacts of Matilija Dam. Matilija Dam is located on the Ventura River 16 miles from the Pacific Ocean. The Ventura River is a steep, short watershed, having some of the highest erosion rates in the United States. This extreme sedimentation, combined with the flashy nature of flood flows, historically transported large amounts of sediment to the coast, forming the Ventura River delta and feeding the sandy beaches downcoast.

Since the construction of Matilija Dam in 1948, the reservoir has filled with six million cubic yards of sediment, all of which was eventually destined for the coast.

The dam traps the coarse particles (sand, gravel, and cobble), which settle out in the reservoir, while passing much of the finer silts downstream. Studies estimate that the fluvial sediment supply from the Ventura River watershed has been reduced by 53 percent, resulting in a significant reduction in the coastal sediment budget. (DBW 2002)

Matilija Dam has never provided any flood control capacity, and its purpose for water supply diminished significantly with the construction of a primary domestic water supply at Casitas reservoir in 1954. Then, in 1965, only 13 years after the reservoir first filled with water, structural concerns led to the removal of a 35-foot notch to reduce the dam's capacity. As shown in Figure 5, even small floods overtop the structure. The dam is obsolete, ineffective for flood control, and has limited value for water supply (ACOE 2002).



Figure 5: Matilija Dam spilling during a 5-year storm, March 2001.

Sediment trapping not only impacts the beaches, but also the biological integrity of the lower reaches of the Ventura River. The river downstream now lacks gravel spawning beds for fish, and in many areas the formerly braided streambed has become a single deep channel within the floodplain.

Most importantly, fish passage to and from the perennial headwaters has been blocked. Stream reaches in the upper watershed serve an essential ecological function for southern steelhead by providing refugia during drought cycles. Unlike the downstream reaches in the alluvial floodplain, these areas generally remain watered during drought periods (McEwan 2001). In this manner, Matilija Dam fragments the watershed, effectively severing the physical and ecological connections between the upper watershed and the coast.

The steelhead population within the watershed has plummeted from an estimated 5000 returning adults to perhaps a dozen. (ACOE 2002) The Department of Fish and Game has placed a priority on the Ventura River (McEwan 1996);

The Ventura River at one time probably supported one of the largest runs of southern steelhead on the south coast. Restoring steelhead runs in this river will be crucial to restoring the southern steelhead stocks.



Figure 6: Ed Henke with a catch of Ventura River steelhead, 1942

Dam removal. Community support for action on Matilija Dam began in the early 1970's with the individual efforts of Ed Henke, a sportsman who grew up in Ventura and fished the Ventura River prior to dam construction (Figure 6). Henke generated resolutions of support from a broad range of public-spirited organizations, but action was slow in coming. It was the late 1990's before this grassroots effort began to "trickle up" in the government process.

Local government endorsement of this project began in 1998 with a resolution signed by BEACON (Beach Erosion Authority for Clean Ocean and Nourishment), a joint powers authority that includes the county governments and coastal cities within Ventura and Santa Barbara counties. BEACON's support highlighted the potential to restore coastal sediment supply and stem regional beach erosion problems in Ventura County. The Ventura County Board of Supervisors, the owners of the dam, followed with a similar resolution in 1999, followed by resolutions from the cities of Ventura, Oxnard, Port Hueneme, and Ojai.

At the state level, the Department of Fish and Game has identified the restoration of the Ventura River steelhead as a priority. The *Steelhead Restoration and Management Plan for California* states that:

DFG should initiate discussions regarding the removal or modification of Matilija Dam. This would restore over 50% of the original spawning and rearing habitat in the Ventura River system. Matilija Creek headwaters lie entirely within the Los Padres National Forest and are still fairly pristine.

The Resources Agency has provided significant support through the California Coastal Conservancy. Much of the funding for a Demonstration Project in 2000, and almost the entire local match for the Feasibility Study (\$1.8M) have come from the State of California. In 2002, Senator Jack O'Connell introduced *Senate Joint Resolution SJR 45* to the State Legislature, which would formalize the support of the State of California and request Congress to undertake measures to remove Matilija Dam. The Assembly did not hear this resolution in 2002, so it will be reintroduced in 2003.

Ecosystem Restoration Feasibility Study. In June 2001, the County of Ventura signed a cost share agreement with the Army Corps of Engineers (ACOE) to begin the *Matilija Dam Ecosystem Restoration Feasibility Study*. The multi-agency study includes experts from several federal and state agencies, including the Bureau of Reclamation, US Geological Survey, National Forest Service, National Marine Fisheries Service, and the California Department of Fish and Game, and others. The objectives of the study are to determine the potential for removing the obsolete dam in order to release or transport the trapped sediments, with the ultimate purpose being restoration of steelhead habitat and nourishment of area beaches. (ACOE 2001)

Since a dam of this type and size has never before been decommissioned, many areas of study are required to ensure success. Following the first year of studies, a "Baseline Conditions Report" was completed in October 2002. This marks a major milestone in the Feasibility Study, and lays the foundation for analysis of project alternatives.

The baseline conditions report concludes that, with the dam in place, the watershed ecosystem will remain degraded in the future. This is because, although high quality habitat still exists in the upper watershed, it remains disconnected from the river and coast. (ACOE 2002)

The sediment trapped behind Matilija Dam has significantly degraded the downstream river and coastal habitats. Surveys reveal that, downstream of the dam, sediment-starved "hungry water" has eroded the riverbed so that it now suffers a deficit of almost two million cubic yards of coarse sand, gravel and cobble. Historically, the river had a broad floodplain with many braided channels. The river now has been reduced in many areas to a single channel cut into the floodplain.

Surveys of the reservoir indicate that it contains approximately six million cubic yards of sediment, including approximately 1.8 million cubic yards of beach quality

sand. While the sediments tested clean, much of the beach sand is intermixed with fine sediment that is not suitable for direct use in beach replenishment. Research indicates that the reservoir will completely fill with sediment by 2020, but will continue to trap sediments until 2030, when some coarse sediment will begin to pass over the dam. At that time the impounded sediments will total over nine million cubic yards.

Structurally, the dam suffers from extensive “Alkali Silica Reaction,” a chemical reaction that weakens the concrete. Despite this problem, there are no structural modifications needed for the dam to remain adequately stable for the next 50 years. An examination of the historic flood records on the Ventura River revealed that Matilija Dam has never controlled peak river flows, and some localized flooding continues to occur with the dam in place. Levees have reduced the flood risk for much of the existing floodplain development.

The next phase of the feasibility study will evaluate various project alternatives for potential future benefits to the ecosystem, as well as cost and technical feasibility. Complete dam removal will offer the greatest benefits, and several approaches have been proposed. Management of the six million cubic yards of impounded sediment is the primary technical challenge. The outcome of the study will be a preferred method for removing the dam while minimizing environmental impacts.

Conclusions

Recent public policy enacted by the State of California provides a framework for restoration of coastal watersheds to revive the State’s coastal resources. Although artificial beach replenishment may serve to restore some of the state’s beaches, a more sustainable and cost-effective solution may be realized through the restoration of natural watershed processes. Planning within the Ventura River watershed includes “managed retreat” from the shoreline at Surfers Point, and the removal of Matilija Dam 16 miles upstream. These combined measures will help to re-establish natural shoreline and watershed processes; providing a long-term solution to coastal erosion, habitat degradation, and the subsequent loss of associated public recreation opportunities. Increased sediment flux from the Ventura River will help stabilize the delta and downcoast beaches. Renewed fish passage will enhance endangered species habitat within the watershed, particularly for the endangered southern steelhead trout, and will increase the likelihood that this species will be able to persist through prolonged drought periods. The lessons learned from these projects will serve as a case study for watershed-based ecosystem restoration to benefit coastal resources.

Recommendations

The following observations and recommendations are offered from the perspective of a nongovernmental coastal advocate working at the local level:

Coordinated efforts generate results. All too often, disparate political agendas impair the long-term opportunities available to local governments and the public interest. The *Coastal Agenda* found that more oversight and coordination is needed within State Agencies:

“Attaining the goals identified in this Agenda is complicated by multiple agencies of jurisdiction, each with respective mandates and responsibilities that are sometimes conflicting or uncoordinated, and other times duplicative.”

And recommended:

- (1) bringing together the many State agencies with ocean and coastal resource management responsibilities to increase coordination efforts and to provide a forum to help resolve issues at the State level and*
- (2) establishing a process for cooperating with and soliciting advice from other levels of government, the public, and the private sector.*

The Surfers Point Managed Shoreline Retreat project is a case study of this issue. Conflicts among state agencies have resulted in a protracted planning process that has lacked the oversight and vision of a coordinated planning effort. To date, planning has largely been left to the local participants. It is evident that *“a forum to help resolve issues at the State level”* is sorely needed.

The Matilija Dam Ecosystem Restoration Feasibility Study is another example of a multi-agency effort to restore California’s coastal resources. Although somewhat cumbersome, this cooperative program draws upon the expertise of a diversity of local, state, and federal agencies. This approach not only enhances the study, but also increases the potential for funding the decommissioning project.

Several coalitions of diverse stakeholders have formed since CWO ‘97. Stakeholder cooperation among fisheries, beaches, and wetlands agencies has resulted in significant progress. Examples of coordination among non-government organizations include the Southern California Steelhead Coalition and the Matilija Coalition. Other actions such as the formation of local task forces of the Southern California Wetlands Recovery Project, a program of the California Coastal Conservancy, have also helped bring diverse stakeholders together.

There is a clear need for cooperation and facilitation in order for diverse stakeholders to reach their common restoration goals. Coordinated policy and funding requests have helped provide support at the local level, but greater oversight by state agencies will be critical for the future success of these and other restoration projects.

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Internet Resources:

Ventura County Flood Control District. www.matilijadam.org

Matilija Coalition. www.matilija-coalition.org