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Damn Sand Rights: Removing Rindge and Matilija Dams

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Abstract

Two dams built in the 1920's and 1940's within southern California coastal drainages have reached the end of their useful lives, and their decommissioning and removal is being actively considered by the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation. Both projects have the potential to replenish downcoast eroded beaches through the release of stored sediments and the re-establishment of natural sediment transport regimes. The removal of these dams are complicated by the disposition of stored sediments, which if released above background levels, could adversely affect downstream properties on adjacent flood plains, as well as sensitive species which occupy coastal wetlands at the mouth of both stream systems. Re-establishment of natural sediment transport is receiving increasingly serious consideration in comprehensive coastal shoreline management programs, and offers an alternative to shoreline armoring and artificial beach nourishment programs.

Introduction

Coastal rivers and streams have long been recognized as the principal sources of natural beach sand supplies in southern California. (Brownlie and Taylor, 1981; Fall, 1981, Griggs and Savoy, 1985). As a result of the construction of dams, flood control facilities, and commercial aggregate extraction from southern California rivers and streams, coastal areas have been subjected to accelerated coastal erosion rates which have threatened both coastal beaches, and adjacent developed shoreline properties (California Department of Navigation and Ocean Development 1977; California Department of Water Resources, 1978; Griggs and Savoy, 1985, Noble Consultants, 1989; Thompson, 1994; U.S. Army Corps of Engineers, 1971, 1980, 1994, 1997, 1998).

Nevertheless, attempts to limit the impacts of accelerated coastal erosion in southern California have focused on two strategies: (1) armoring the coast with a variety of shoreline protection structures, including concrete seawalls and rock rip-rap; and (2) artificially supplementing beach sand supplies through beach replenishment programs (Aceti and Avendano, 1999; Flesh, 1993; Flick, 1993; National Research Council 1995; Noble Consultants, 1989; Shaw, 1980; Wiegel, 1994).

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The legal theory of sand rights was advanced over ten years ago to protect beach sand as a public trust resource. (Stone and Kaufman, 1988; Stone, 1999) However, little progress has been made to advance this theory, either by asserting downcoast sand rights against upcoast property interests within a littoral cell, or by restoring the natural supply of sand to beaches that has been interrupted as a result of dams or flood control facilities constructed in southern California coastal rivers and streams.

Over the past seventy-five years, numerous dams and debris basins have been constructed in coastal watersheds that have interrupted natural sand supplies in southern California. Major dams affecting the Santa Barbara and Santa Monica littoral cells between Point conception and the Palos Verdes Peninsula include: Twitchell Dam on the Santa Maria River, Bradbury, Jameson, and Juncal Dams on the Santa Ynez River, Casitas and Matilija Dams on the Ventura River, Piru, Pyramid, Casitas, and Bouquet Dams on the Santa Clara River, and Sherwood, Westlake, Malibu, Century and Rindge Dams on Malibu Creek (California Department of Water Resources, 1988; U.S. Soil Conservation Service, 1992).

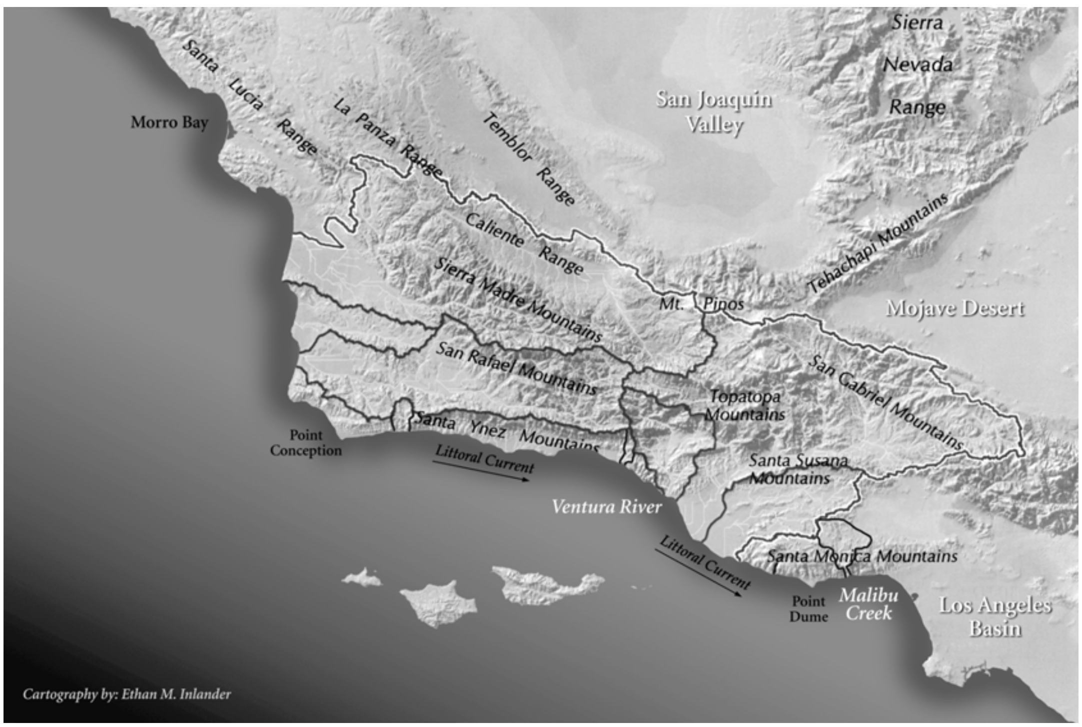

Figure 1. Coastal watersheds and littoral currents of southern California.

While some preliminary planning and evaluation of has been undertaken by local agencies to develop a sediment clean-out program for debris basins, until the recently proposal to remove Rindge and Matilija Dams on Malibu and Matilija Creeks in Los Angeles and Ventura Counties, there have been no significant efforts to re-establish the natural transportation of sediments from inland sources to the southern California coast as part of a coastal management program. (Noble Consultants, 1989) The current proposals to remove Rindge and Matilija Dams were initially spurred by interest in recovering the federally endangered steelhead trout, but have also been viewed as means of addressing coastal erosion problems in southern California (Allen, 1993; Bailard, 1999, Brauner, et al. 1999; Gray, 1999;U.S. Bureau of Reclamation, 1995).

Rindge Dam

Rindge Dam on Malibu Creek is located approximately 2 miles inland from the coast near the City of Malibu (Los Angeles County). The dam was originally constructed in 1926 by a private landowner for a local water supply. Rindge Dam is currently owned by the California Department of Parks and Recreation and lies within Malibu State Park. The dam consists of a concrete arch structure, approximately 100 feet high, and originally stored approximately 600 acre-feet of water. The reservoir has been completely sedimented in since the late l950's, and currently stores an estimated 0.8 to 1.6 million cubic yards of sediment, consisting of a mixture of silts, sand, and large cobbles. It is estimated that approximately half of the stored sediment may be suitable for beach nourishment (Allen, 1993; Law/Crandall, 1993; Stotsenberg, N.D.; U.S. Bureau of Reclamation, 1995).

Figure 2. Rindge Dam, Malibu Creek. Note vegetation colonizing stored sediments behind dam.

The Malibu Creek watershed encompasses approximately 100 square miles and is situated in the Santa Monica Mountains which are comprised of recently uplifted marine sediments that are unconsolidated and therefore easily eroded. Malibu Creek is an important source of beach sediment for the Santa Monica littoral cell. Malibu Creek watershed is estimated to produce approximately 150,000 cubic yards of sediments annually. (U.S. Army Corps of Engineers, 1994) The high rate of sediment production in the Malibu Creek watershed is evident by the development of a prominent marine delta at its mouth. The marine delta is the site of commercial and residential development that has experienced damage as result of shoreline erosion (U.S. Army Corps of Engineers, 1994; U.S. Soil Conservation Service, 1967, 1992; Trim, 1994) The marine delta at the mouth of Malibu Creek also supports a coastal estuary which provides important habitat for a wide variety of migratory birds, and a number of species which have been listed as federally threatened or endangered such as the California least tern, Western snowy plover, Tidewater goby, and Southern steelhead trout

(Capelli, 1997, 1999; Franklin and Bobush, 1989; Gearheart and Waller, 1989; Keegan, 1990; Trim, 1994).

Figure 3. Malibu Creek watershed comprised of recently uplifted marine sediments covered with chaparral. Note Malibu Canyon Road in foreground.

Figure 4. Malibu Creek marine delta and estuary. Note residential development along shoreline.

In 1992, the California Department of Fish and Game initiated an investigation into the removal of Rindge Dam as part of an effort to restore the remnant run of steelhead in Malibu Creek. Subsequently, the U.S. Bureau of Reclamation performed an Appraisal Level study of the removal of the Rindge Dam. Because of the steep canyon location, limited vehicular access, and the large volume of sediments, both investigations identified removal of sediments as the major obstacle to removing Rindge dam, but recognized the potential value of the stored sediment for beach nourishment. Because the reservoir behind Rindge Dam is currently filled with sediment, it currently has minimal effect on current sediment transport; its removal would therefore provide a one-time benefit to beach local beaches, providing its sediments were transported to nearby beaches as part of the dams removal (Law/Crandall, 1993; U.S. Army Corps of Engineers, 1994; U.S. Bureau of Reclamation, 1995).

Removal of sediments by trucking would have major impacts on the limited road capacity of Malibu Canyon Road, as well as air quality impacts. Removal through incremental notching of the dam structure, and reliance on periodic flooding, has the potential to adversely impact downstream properties sand habitats as a result of elevated sedimentation. This approach could also extend the project over several decades, depending on the long-term rainfall and runoff pattern in the Malibu Creek watershed. One possible means of removing the sediment is through a mechanical conveyor mechanism which would allow controlled transport of sediment and avoid the impacts to traffic, air quality, and environmentally sensitive habitats associated with other sediment transport options. (U.S. Bureau of Reclamation, 1995) The U.S. Army Corps of Engineers is developing a work plan for a Reconnaissance Study to determine the most feasible way of removing the structure and the stored sediments (U.S. Army Corps of Engineers, 1998).

Matilija Dam

Matilija dam is located on Matilija Creek, a tributary to the Ventura River, approximately 18 miles inland from the coast near the City of Ojai (Ventura County), and lies within the Los Padres National Forest. Matilija Dam was constructed in 1946 by the Ventura County Flood Control District for water supply and flood control. Matilija Dam is currently leased to the Casitas Municipal Water District and operated in conjunction with the Robles Diversion on the main stem of the Ventura River. The dam consists of a concrete arch structure, approximately 200 feet high, and originally stored approximately 7,000 acre-feet of water. Matilija Reservoir is 90% filled with sediments, and currently stores an estimated 5 to 7 million cubic yards of sediments (Brauner, 1998; U.S. Bureau of Reclamation, 1999a, 1999b).

The Ventura River watershed is encompasses 200 square miles and is composed of recently uplifted, unconsolidated marine sediments, which are highly erosive. The processes of erosion are accelerated by periodic wildfires that denude the chaparral covering rock formations exposing these rock formations to intense winter storms. The Ventura River is an important source of beach materials in the Santa Barbara littoral cell. It is estimated that the Ventura River watershed produced approximately 26,000 cubic yards of sediments annually. (Brownlie and Taylor, 1981; U.S. Army Corps of Engineers, 1997; U.S. Geological Survey, 1988) Because of this high sediment load, the Ventura River has formed large a marine delta at its mouth. As with Malibu Creek, this marine delta supports a coastal estuary which provides important habitat for a wide variety of migratory birds, and several federal and state listed endangered species, such as the Least tern, Western Snowy Plover, Tidewater goby, Southern steelhead. The Ventura River estuary is part of the Emma Wood Sate Beach and the

City of San Buenaventura's Seaside Wilderness Park (Capelli, 1997, 1999, Casitas Municipal Water District, et al., 1997; Ferren et al. 1990, Hunt, et al. 1992).

The marine delta has been bisected by a major flood control levee and developed with a variety of industrial, residential, commercial, and recreational facilities. The shoreline immediate downcoast of the mouth of the river has experienced served coastal erosion as a result of the deprivation of sediments caused by the two major impoundments (Casitas Dam and Matilija Dam) in the watershed (Noble Consultants, 1989).

In 1999, the County of Ventura proposed removing Matilija Dam as part of a project to restore the remnant steelhead runs in the Ventura River. The County of Ventura, along with the Ventura County Flood Control District, requested the U.S. Bureau of Reclamation to conduct an Appraisal Level study of the removal of the Matilija Dam. As with Rindge Dam, a preliminary assessment has identified removal of the sediment stored behind Matilija Dam as the major obstacle to the dam's removal.

Removal of stored sediment through incremental notching of the dam structure, and reliance on periodic flood flows has the potential to adversely impact downstream residential properties along Ventura River floodplain. Additionally elevation of the sediment levels in the main stem of the Ventura River could adversely affect the operation of the Robles Diversion, which diverts water from the Ventura River to the Casitas Reservoir. This approach could also extend the project over several decades, depending on the pattern of rainfall and runoff in the Ventura River watershed. One possible means of removal the smaller sized sediment is through a slurry pipeline which would allow controlled transport of sediment and avoid impacts to traffic, air quality, and environmentally sensitive habitats associated with the other sediment transport options (Bailard, 1999; U.S. Bureau of Reclamation, 1999a).

Figure 5. Matilija Dam. Note large notch removed from dam face, reducing storage capacity.

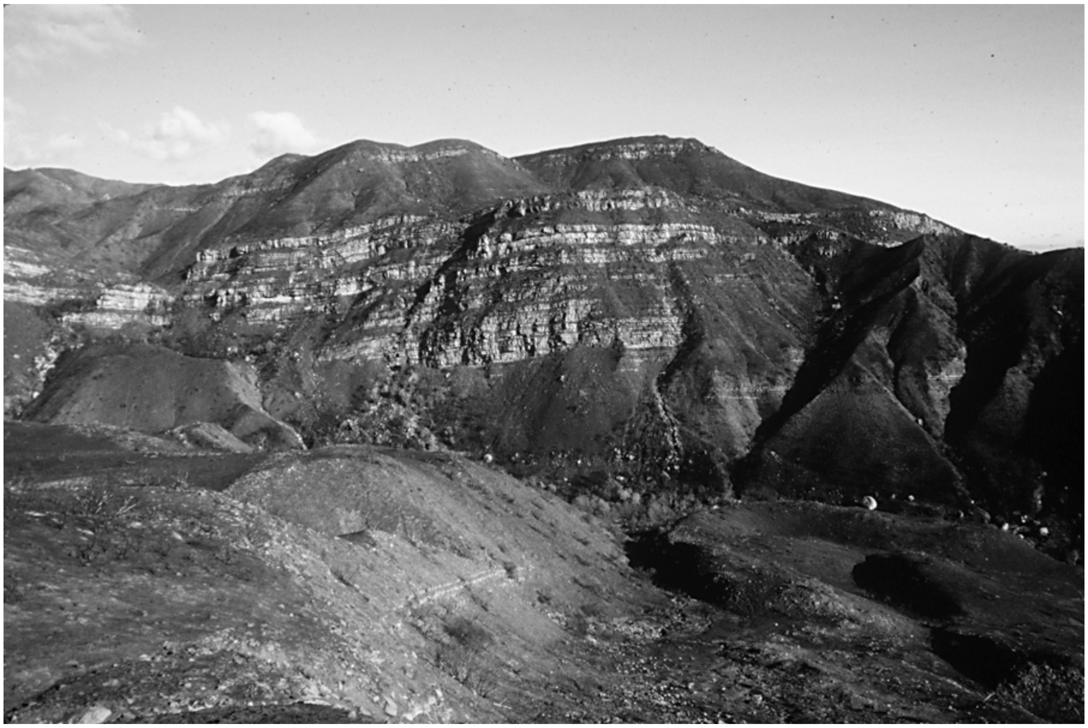

Figure 6. Matilija Creek watershed composed of recently uplifted marine sediments. Note denuded slopes following wildfire.

Figure 7. Ventura River marine deltas (upper left) and downcoast area. Note shoreline development, including Ventura Marina (lower right).

Discussion

The physical removal of both Rindge and Matilija dams can be accomplished by using relatively straightforward construction techniques for cutting, decomposing, and removing concrete. However, the removal and disposal of the large amounts of sediments stored behind the dams has slowed the planning for the removal of these structures. The sediments stored behind these structures consist of native sedimentary materials, ranging is size from fine sediments to larger sandstone boulders. Because these materials would have been naturally transported to the coast in the absence of the dams, and therefore contributed to the maintenance of beaches, there is considerable interest in using the stored sediments for beach nourishment.

Planning will require developing an accurate estimate of the total volume of stored sediments, as well as the relative amount of various sediment sizes. Additionally, the presence and character of any contaminants (including organic materials) in the in the sedimentary material stored behind the dams must be determined before their suitability for beach nourishment can be determined. To date, only preliminary estimates have been made for the total volume or the distribution of sediment sizes behind the Rindge and Matilija Dams. This information is critical is determining the amount of materials which may be suitable for beach nourishment and the most efficient means of transporting the material to the coast.

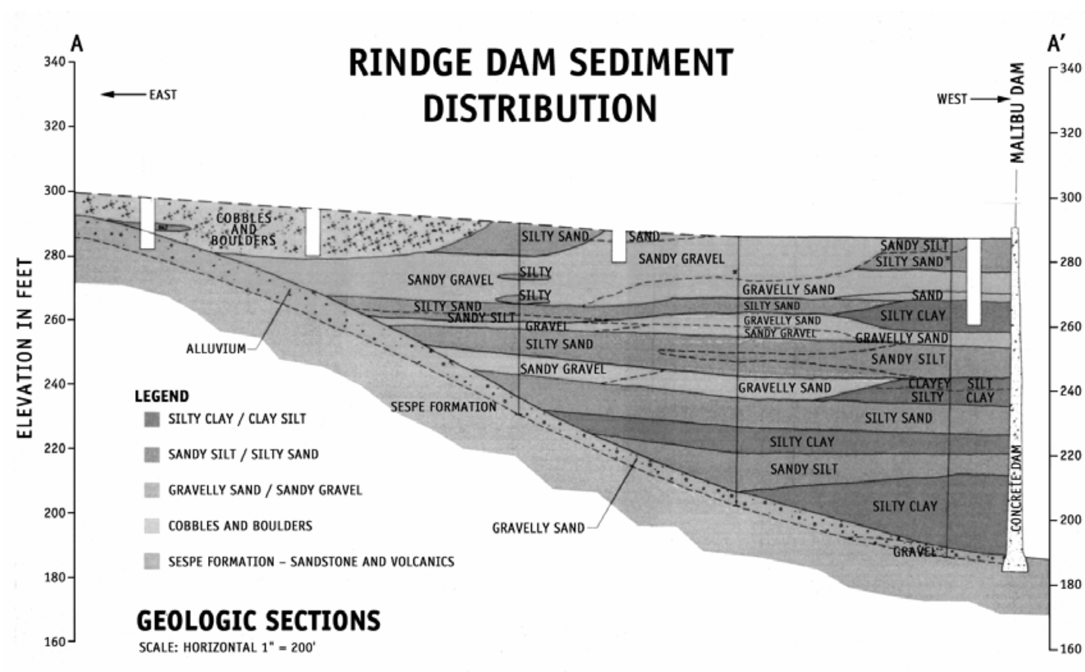

Figure 8. Estimated distribution of sediments sizes behind Rindge Dam. Adopted from Law/Crandall (1993).

The sudden release of stored sediments into the downstream channels of either Malibu Creek or the Ventura River as a result of removing the dam structures, whether all at once or incrementally, could adversely affect the downstream sensitive habitats, including the estuaries, of the two stream systems. These habitats support a variety of fresh and brackish water species, including the federally endangered Southern steelhead and the Tidewater goby that could be adversely affected by sediment deposited in riverine or estuary habitats.

Figure 9. Damaged bikeway on Ventura River marine deltas due to coastal erosion induced by construction of dams in the Ventura River watershed.

Several alternatives have been preliminarily identified for dealing with the transportation and disposition of stored sediments: (1) phased removal of the dam structure, coupled with temporarily stabilizing the sediments stored behind the structure to meter the sediments transported through the system under the influence of seasonal high flows; (2) excavating the sediments and hauling them to receiver sites (including eroded beaches) via trucks; (3) excavating and transporting sediments via a mechanical conveyor system downstream to the mouth of the respective water courses; and (4) conveying sediments through a slurry-pipe downstream to coastal beaches.

The technique(s) best suited to transport and dispose of stored sediments will depend upon a variety of factors including, the distance from the dam site to the receiver site, the feasibility of moving sediments on local and regional roads, the accessibility of the dam site and downstream route to mechanical equipment such as conveyor systems, and the availability of water to supply a slurry pipe. Additionally, a complete characterization of the sediments to be transported and disposed, including, grain size fractions, presence of contaminants, and total volumes of materials suitable for beach nourishment, must be accurately determined before these options can be evaluated.

Conclusion

Decommissioning and removing non-functioning dams is a relatively new and largely untried endeavor, but with the increasing number of dams approaching the end of their useful lives, removal of dams is becoming an increasingly important option for restoring and maintaining beach sand supplies in coastal areas (American Rivers, 1999; Friends of the River, 1999).

The continued erosion of southern California beaches coupled with the uncertain effectiveness of shoreline armoring, and the high cost of artificial beach nourishment programs, provides additional incentives to explore the removal of non-functional dams and other impoundments (King and Potepan, 1997). Any comprehensive coastal management plan should consider the inland source of beach material, as well as its movement along the littoral cell, and evaluate the possibility of removing or modifying structures which obstruct the natural flow of sediments to the shoreline to protect the valuable beaches of southern California.

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