ERTEC Environmental Systems

Protecting the Integrity of Global Lands and Waterways™

Case Study

Application: Bio-Technical **River Bank Stabilization**
Product: Bank Stabilization System ™
Location: Decker Island Levee Bank Stabilization Project
Customer: State of California Department of Water Resources
Delta Levees Program
Installation: October 2002

Project description and background

Exposed bank (see white arrow in Figure 1) – at northwest tip of Decker Island on Sacramento River – original rock-retaining berm washed away. Heavy, swirling currents, heavy winds and large pieces of driftwood serve to scour shoreline away at a rate of 5 ft per year.

Previously used as a disposal site for sediment dredged from the Sacramento River to enhance navigation, parts of Decker Island were covered with up to 20 feet of overburden. The erosive forces of wind, wave, driftwood, and tidal actions constantly assault the vulnerable levee banks composed of sandy-silt material that is easily transported into the air and water due to its friable texture. Several "scallops" formed on the west-side near the northern tip of the island and resulted in significant loss of levee bank and associated riverside habitats. A series of these erosion pits (up to 60 feet wide) are believed to be the due to a breach in the rock containment barrier that was constructed after the turn of the century. Without a wave barrier, the forces of nature chip away the toe of the bank, which eventually slumps back into the water to begin the repetitive cycle over again. In one stretch alone, an eight-foot vertical bank receded over 50 feet in the last ten years. To reduce the erosion and potential threat of levee failure at this site, the Department of Water Resources' Delta Levees Program used a cost-effective alternative to the conventional use of rock rip-rap, which has limited advantages beyond stability.

Figure 1: Location of ERTEC project on Decker Island

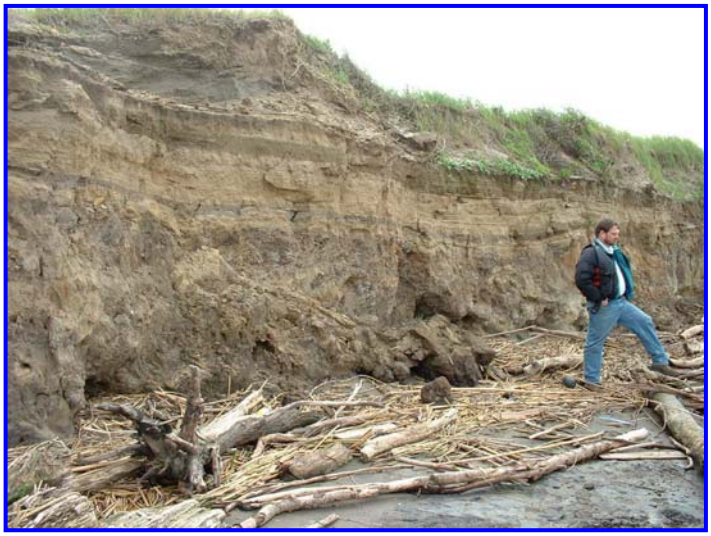

Figure 2: Pre-project site conditions

The problem to be solved

The Delta Levees Program, in collaboration with the Department of Fish and Game completed a demonstration project to: 1) improve water quality at the site; 2) protect existing waterside vegetation and an interior 15-acre restored wetlands area – by reducing the possibility of a breach into the new habitat area; 3) provide appropriate site conditions for the establishment of native plants; 4) increase the slope stability and integrity of 60 linear feet of vertical levee bank; and, 5) test the efficacy and long-term protection provided by new materials and methods on a small scale.

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Figure 3: Installation in progress

Figure 4: Installation complete

Possible Consequences

A breach in the outer perimeter could have destroyed newly restored habitat or changed the hydrodynamics of the wetlands functions and costs to repair could have been significant.

Alternatives

- Restoration of rock-retaining berm. Deferred because of high cost and time constraints.
- Rip-Rap. Eliminated because of limited access and high cost to install boulders in remote location and vertical slope. Wide stretch of shallow water precluded placement of rock from the water side and rough, uneven terrain precluded use of heavy equipment without significant re-contouring. There were also concerns about Rip-Rap's negative impact on fish and wildlife habitat.

Solution

The erosion-control structures selected for the project were one-foot diameter polygonal modules (ERTEC Environmental Systems) of high-density polyethylene (HDPE). Each set consisted of two 2', one 4', and one 6' length fastened into a staircase buttress design. Two sets were fastened to each other to increase structural integrity, forming a module two feet wide. To increase soil retention, a 300-micron AOS filter fabric was layered between the module walls. Using labor crews from the Department of Corrections under the supervision of a fire captain from the Department of Forestry and Fire Protection, the project commenced under compatible tide and construction window conditions. Initial clearing of debris and soil excavation provided a level footing to set the modules. The perimeter surfaces and bottom of the modules were wrapped with heavy-duty filter fabric to provide additional soil retention and wave attenuation. The sets were then anchored with stainless steel cable and "duckbills" that were driven 3-5 feet into the face of the bluff. Cables were also wrapped and clamped around adjacent modules. As installation was completed, crews back-filled the modules and voids with loose soil and compacted it with water to create a rigid, but semi-permeable structure. As a last step, crews recessed the top of the bank prior to re-vegetating it with plugs of native grass and willows in and around the modules. Post-storm season conditions 2003, 2004 and 2005 indicate the structure held up well against heavy debris and native grasses and willows are growing profusely creating complex habitat. Flood conditions (high flows, tides and wind) will ultimately determine the utility of this innovative project.

Results

After three storm seasons – the bank has stabilized. Profuse vegetation is established and riparian habitat is enhanced. Erosion is significantly reduced.

Summary

This was a successful program for the following reasons: Low cost, Simple installation, Robust solution, Immediate reduction of bank erosion and loss, and protection of existing resources. In summary, the Decker Island Levee Bank Erosion Reduction Project combines high-tech with low-cost to achieve a sound engineering solution for multiple benefits, and reflects the goals of the Delta Levees Program as a whole.

Figure 5: 2 months after install

Figure 6: 2 years after installation