BIOENGINEERED BANK STABILIZATION:
Restoring eroded vertical bank to usable habitat in the Missouri National Recreational River

Project Purpose
Lewis & Clark Regional Water System (Lewis & Clark) is in the process of developing a high-quality three-state water supply system to serve the growing needs of southeastern South Dakota, southwestern Minnesota, and northwestern Iowa. In order to protect the well field adjacent to the Missouri River (approximate river mile 777.8 to 776.7), Lewis & Clark would require a 5,120-foot-long bank stabilization.

Environmental Concerns
This specific stretch of the Missouri River, near Vermillion, South Dakota, is designated as the Missouri National Recreational River (MNRR) under the Wild and Scenic Rivers Act. The National Park Service (NPS) had concerns with conventional riprap bank stabilization applications and the ability to preserve the outstandingly remarkable values of the MNRR. To address these concerns, the bioengineered bank stabilization incorporated a soil-choked stone toe, 115 cottonwood and cedar tree locked logs (113 total) harvested from the bank were locked into the stone toe, oriented slightly downstream to allow shedding of ice and debris. Throughout the riprap, 49,000 unrooted willow poles were integrated and 59,300 rooted stock plants (cottonwood and red osier dogwood saplings) were planted along the upper bank. All of the exposed revetment was covered with soil and seeded with native grasses and forbs. The revetment also included animal travel corridors to allow wildlife to access both the river and the upland.

Permitting Requirements
The U.S. Army Corps of Engineers (the Corps); South Dakota Regulatory; U.S. Fish and Wildlife Service; South Dakota Game, Fish and Parks; South Dakota Department of Environment and Natural Resources; and South Dakota State University, required extensive coordination with the Bureau of Reclamation; Lewis & Clark; NPS; the Corps; U.S. Fish and Wildlife Service; South Dakota Game, Fish and Parks; South Dakota Department of Environment and Natural Resources; and South Dakota State University.

Design
Typical locked-log installations place the log at a 90-degree angle from the bank or point the log slightly upstream, with the rootwad in the waterway. This is reversed in our application for two reasons. First, the downstream orientation allows debris and ice to flow freely during these high-flow and ice-out conditions. Second, placing the rootwads in the revetment stabilizes both the log and the revetment.

Construction
After grading the bank back to stabilize the slopes, the contractor placed 5,120 feet of stone toe revetment. Red cedar or cottonwood locked logs (113 total) harvested from the bank were locked into the stone toe, oriented slightly downstream to allow shedding of ice and debris. Throughout the riprap, 49,000 unrooted willow poles were integrated and 59,300 rooted stock plants (cottonwood and red osier dogwood saplings) were planted along the upper bank. All of the exposed revetment was covered with soil and seeded with native grasses and forbs. The revetment also included animal travel corridors to allow wildlife to access both the river and the upland.

Result
Constructed in the winter of 2007-2008 and followed by a wet spring 2008, the bank stabilization now blends seamlessly into its surroundings. This project serves as an example of using bioengineering techniques for bank stabilization on a major river system to protect infrastructure from lateral migration, yet preserving the natural state and restoring usable habitat for fish and migratory birds. In May 2009, this project was awarded the U.S. Department of Interior Partners in Conservation Award in recognition of outstanding conservation achievements attained through collaboration and partnership with others.