

Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE DEC 2004		2. REPORT TYPE		3. DATES COVERED 00-00-2004 to 00-00-2004	
4. TITLE AND SUBTITLE USACE Sets the Rappahannock River Free				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Engineer School,14010 MSCoE Loop BLDG 3201, Suite 2661,Fort Leonard Wood,MO,65473-8702				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 2	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

USACE Sets the Rappahannock River Free

By Ms. Nancy Allen and Mr. Christopher Augsburger

The US Army Corps of Engineers (USACE), usually known for designing and constructing water control structures, has taken on a very different engineering challenge—bringing down a 150-year-old dam.

On 23 February 2004, the Norfolk District of USACE began this historic mission. Six hundred pounds of explosives set by the Army and Air Force Reserves blasted a 130-foot section in the middle of Embrey Dam in Fredericksburg, Virginia, allowing the Rappahannock River to flow freely for the first time in more than 150 years. The detonation opened approximately ten 10-foot holes in the structure, allowing fish to pass through as part of their natural migration cycle.

The Rappahannock River flows 184 miles from a spring in the Blue Ridge Mountains to the waters of the Chesapeake Bay. Fredericksburg, a historic Virginia town founded in 1728, sits at the fall line of the Rappahannock. A wooden crib dam was the first dam built on the falls in 1853. In 1910, the Fredericksburg Water Power Company finished construction on a 770-foot-long,

22-foot-high concrete dam that spanned the Rappahannock River. The Embrey Dam was an Ambursen-type dam, consisting of a series of reinforced concrete buttresses (14 feet on center) with sloped (38 degree) concrete slabs on the upriver side. It was used to generate hydroelectric power until the 1960s. The city of Fredericksburg also used water diverted by the dam into the Rappahannock Canal as a raw water source for the city's supply until early 2000.

In 1985, a group of Fredericksburg business owners, politicians, and community members formed Friends of the Rappahannock (FOR), which focused on keeping the river healthy—among other missions. One of their primary concerns regarding the health of the river was the decline of migratory fish stocks, such as American shad, hickory shad, blueback herring, and striped bass that were once so plentiful in the Chesapeake Bay watershed. These anadromous species spend most of their lives at sea and only enter freshwater rivers, such as the Rappahannock, to spawn.

Together with the Virginia Department of Game and Inland Fisheries, FOR began to raise awareness of the migratory fish passage problem. Fish elevators and other solutions were not feasible at Embrey, and the groups advocated complete removal of the dam.

There were other factors supporting the removal of the dam, the greatest of which was that it had fallen into disrepair and would cost the city millions to rehabilitate. Another factor was safety, since the citizens of Fredericksburg frequently played in and around the dam. In addition, canoeists and kayakers traveling on the river were forced to portage around the dam.

By the mid-1990s, the city of Fredericksburg began working with neighboring Spotsylvania County to develop new regional water supply solutions. These discussions made it clear that the water plant connected to the Embrey Dam could be closed, thus eliminating the last major “need” for the dam.

One of the major obstacles to removing the dam was the cost and

funding sources. As early as 1992, city officials met with USACE to discuss the feasibility of removing the dam using federal funds. Then the push to remove Embrey Dam received a major boost in May 1996 when FOR invited Virginia Senator John Warner for a roundtable discussion about the project. The Senator pledged that if the group could demonstrate that there was community consensus to take down the dam, he would take it on as a personal project.

The senator arranged for \$100,000 for the Corps to conduct a reconnaissance study. Engineers, biologists, oceanographers, planners, economists, archaeologists, social scientists, and other subject matter experts from the Corps's Norfolk District collected and analyzed a vast amount of data. In the end, the study had to weigh the project benefits against any potential adverse project impacts and ultimately determine if any aspect of the Embrey Dam removal would result in significant, long-term adverse impacts on environmental resources.

In 1998, the Corps concluded that fish passage and the restoration of the Rappahannock River was in the public interest, making the project eligible for federal funding. The preferred alternative called for building a sediment containment area, dredging behind the structure, and completely removing Embrey Dam. It would restore more than 100 miles of main stem fish spawning and rearing habitat, open up the longest flowing river in the Chesapeake Bay drainage, enhance the Rappahannock for anglers and recreational users, and save the city of Fredericksburg millions. A year later, the Water Resources Development Act authorized \$10 million for the project.

In March 2003, after the necessary permits had been obtained, the Norfolk District hired a contractor to oversee the removal of 250,000 cubic yards of sediment. This was to minimize any possible impact from increased sediment levels downstream during the breaching. The project plan called for a section of the dam to be breached using explosives in February 2004. Timing was critical



Photo courtesy Davis Turner, The Free Lance-Star

The removal of Embrey Dam was dubbed Operation Noah Shiva.

because the dam had to be breached in time for fish to take advantage of the newly reopened fish passage during the spring migration season.

The Corps began working with the US Army Dive Company and the US Air Force 555th RED HORSE Reserve Squadron on the demolition under the Department of Defense's Innovative Readiness Training (IRT) program. The IRT program was developed to find ways to use the military's unique resources and capabilities to serve American communities in need while providing realistic military training benefits. The team developed a plan to blast about 10 of the buttresses, or about 130 feet of the dam. Divers worked in 35-degree water, drilling hundreds of holes into which some 650 pounds of explosives would be placed. The operation was named "Noah Shiva" after the biblical account of Noah and the great flood and the Hindu god for destruction and rebirth.

Although only ten percent of the charges ignited the first time, a second blast occurred shortly afterwards, and the Rappahannock was flowing freely for the first time since 1853. The river rose quickly, but no downstream flooding occurred—as predicted by the Corps's hydrological models—and then the river dropped back to its normal levels.

The remaining sections of the dam will be removed by mechanical means.

The project is scheduled for completion in 2006. Embrey Dam will be the largest dam removed in the United States since 1999, when the Edwards Dam was removed from the Kennebec River in Maine.

This project was unique because of all the different partners it brought together, including not only city, state, and federal agencies but also military and environmental representatives at every level. By reopening more than 1,300 river miles to migratory fish in the Chesapeake Bay watershed, we are allowing American shad and blueback herring to reclaim their native waters as part of our concerted effort to restore the life of the Bay.



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