



US Army Corps
of Engineers

Water Quality Technical Note MI-01
January 1996

Shoreline Protection on Reservoirs with Fluctuating Pool Levels

by John Andersen

Purpose

This technical note presents a possible solution to reservoir shoreline erosion due to vertical pool fluctuations.

Problem

Reservoirs in which pool elevations fluctuate significantly in response to hydropower or flood control activities often exhibit massive shoreline erosion problems. Sediment input due to shoreline erosion will cause significant ecological damage to the reservoir fishery, littoral zone habitat, benthos, and overall reservoir ecology. Large vertical pool fluctuations will prevent stability of the littoral zone for literally decades. Shoreline erosion at Fort Peck Lake, in the Corps of Engineers' Omaha District, has been occurring for 40 years and is still a severe problem that shows no sign of slowing. Shoreline erosion, no matter what the cause, will impact the ecology and recreational uses of a reservoir significantly. While flood control and hydropower may not be significantly impacted, these are only two very simple volume functions in a very complex biological system.

Because of pool-level fluctuations, vegetative shoreline erosion prevention methods cannot be used since plants will be desiccated at low pool and submerged at high pool. Riprap, the standard method of handling such problems, is effective but cost prohibitive, especially when miles or hundreds of miles of shoreline are involved.

On many eroding shorelines, significant quantities of rock are left behind on the "beached" area of the shoreline as the vertical bank erodes. This process, referred to as natural armoring, leaves rock too heavy to be washed away by wind and wave forces. Unfortunately, this "natural armoring" is often inefficient and does not protect the eroding vertical bank to any significant degree.

Solution

The rock remaining on the beach area of an eroding shoreline can be used to protect the banks of reservoirs whose pool elevations fluctuate too much to make vegetative methods practical. In addition, such rock is cheaper than quarried rock, which must be purchased and hauled considerable distances, making standard methods of riprapping too expensive for serious consideration.

The rock remaining as a result of erosion and natural armoring can be used to protect eroding banks. The rock in a scattered state can be collected using a rock picker, a conventional piece of farm machinery used in some areas of the United States and Canada. The equipment is available from farm implement dealers and can be purchased for less than \$15,000. A tractor is required to operate the rock picker. Most area offices associated with main stem dams have tractors as part of their normal operating equipment.

The scattered rock is collected using a rock picker and is arranged in a windrow pattern (Figure 1) on the beach area of the eroding shoreline. This method of bank protection must be timed to coincide with low pool elevations to allow collection activities. It is suggested that the windrow be located some distance from the vertical bank since continued erosion, bank failure, or slumping will result in sediment accumulating behind the windrow. (The windrow should be located "far enough" from the vertical bank so that the weight of sediment accumulating behind the windrow will not force or push the windrowed rocks out of position.)

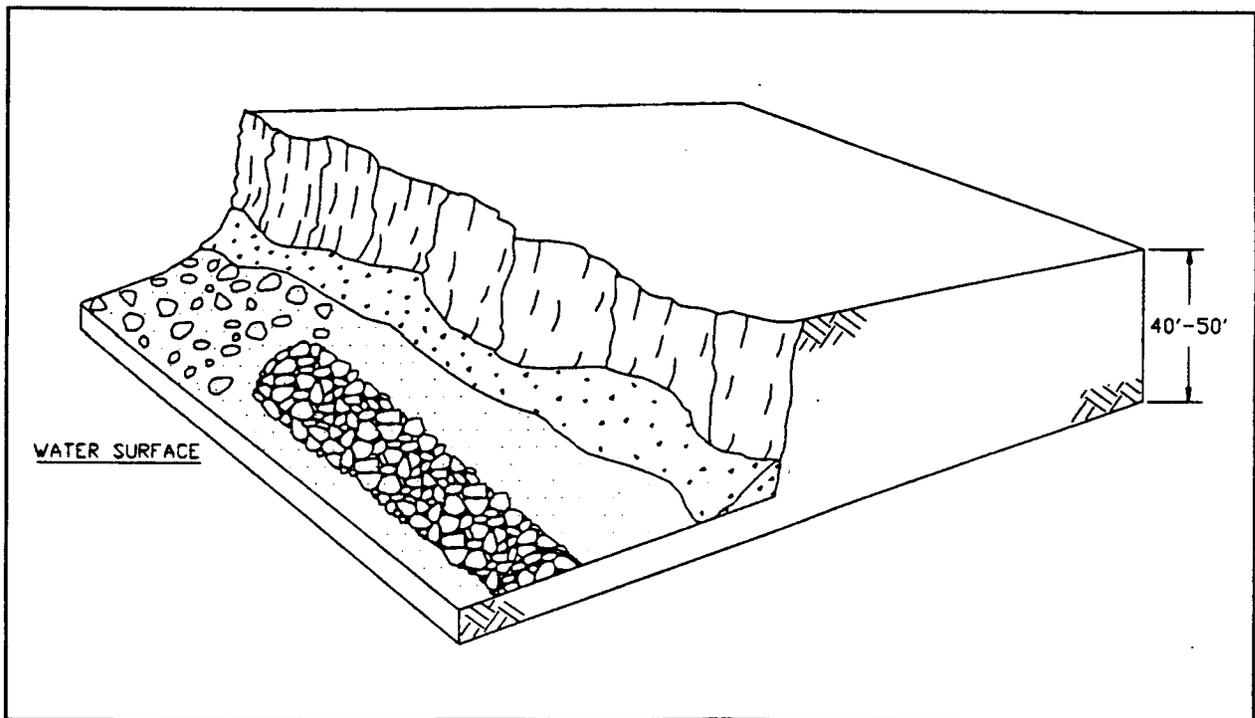


Figure 1. Rock windrow

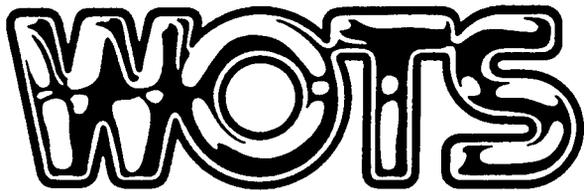
This method is practical only in areas where the beached area of an eroding shoreline contains significant quantities of appropriately sized rock.

Costs

This methodology requires a rock picker (purchase cost \$15,000 or less, depending on the model), a tractor to pull the rock picker (available at most project offices), and an operator.

Point of Contact

For additional information contact Dr. John Andersen, U.S. Army Engineer District, Omaha, (402) 221-4622.



WATER OPERATIONS TECHNICAL SUPPORT