

PROJECT #1: FLEMING CREEK

PROJECT TYPE: Stream bank repair and protection

PROJECT SCALE: Small

CLIENT/OWNER: Matthei Botanical Gardens
The University of Michigan

TECHNIQUES EMPLOYED: Rock vanes,
Live pole planting

GEOGRAPHIC LOCATION: Fleming Creek
Northfield TWP
Ann Arbor, MI



Fig. 1 Fleming Creek rock vanes

GEOMORPHIC SETTING: Fleming Creek is a scenic, meandering stream that flows into the Huron River. It drains an area of 31 square miles, through the townships of Ann Arbor, Superior, Northfield, and the City of Ann Arbor. Fleming Creek runs through the Parker Mill County Park and once provided motive power for that mill. It also flows through the University of Michigan, Matthei Botanical Gardens. The stream bank remediation site is located adjacent a walking trail along Fleming Creek ([Fig. 1](#)).

SITE CONDITIONS AND PROBLEMS: Scour erosion at the outside bend of the stream had removed up to 10 ft of the bank and produced a near vertical, unstable slope. The stream channel was also beginning to encroach into the walking path (see [Fig. 2](#)). Erosion and bank scour were caused by high velocity, impinging flows that occurred during storm events.



Fig. 2 Stream bank before treatment

TREATMENT OBJECTIVES AND CONSIDERATIONS: The main consideration was the need to arrest erosion and stabilize the bank in an environmentally sensitive manner. The repair technique selected had to redirect stream flow away from the bank, stabilize the bank, promote a diverse hydrologic regime, and preserve existing aquatic habitat. An approach was needed that would avoid sloping back or regrading the bank. This action would have resulted in additional loss of bank at the top. These considerations and requirements dictated the use of structures placed in a transverse direction to the bank such as groins, vanes, or bendway weirs. Rock vanes were selected as the most suitable alternative to achieve these objectives. The vanes were placed in conjunction with live willow poles that were inserted into the soil along the toe of the bank and in the vane keyways.

TREATMENTS SELECTED

Rock vanes. Elongated, rock prisms with a triangular cross section were placed at strategic locations to deflect or redirect impinging flow away from the eroding bank. The vanes were oriented in an upstream direction at a 30° angle with the bank. The vanes sloped down from the bank to a point at their upstream end. The vanes were submerged along most of their length (except at very low water) and only encroached into the stream channel about one-fourth of the channel width. The vanes were keyed into the bank (by placing rock in a trench oriented perpendicularly to the bank) to prevent flow from cutting around the vanes during high water (see [Fig. 3](#)).



Fig. 3 Construction of keyway for a rock vane



Fig. 4 Placement of willow poles in keyway

Live willow pole planting. Live willow poles or cuttings were inserted into the sides of the key way trenches and also along the toe of the bank (see [Fig. 4](#)). The cuttings eventually rooted and leafed out. This vegetation provided additional protection against erosion and bank scour.

Rock sill removal. An old rock sill placed on the channel bottom was removed prior to construction of the rock vanes. This sill was oriented in such a way that it actually directed flow into the eroding bank.

OBSTACLES TO IMPLEMENTATION: The rock vanes were installed using volunteer and prison inmates from the county sheriff's department. Initially one of the main obstacles to implementation was lack of familiarity on the part of both regulators and installers with redirect techniques such as rock vanes. Regulators even expressed some skepticism about the technique because of this lack of familiarity and unawareness of the superior benefits provided by flow redirection as opposed to bank armoring. The placement of silt curtains around the site was required in advance of and during construction. However, no evidence of significant turbidity was manifest. The keyway trenches were excavated and rock placed by machine; on the other hand, the rock vanes were placed by hand. The latter was not a serious limitation because of the relatively small size and number of vanes used on this project.

PERFORMANCE EVALUATION: The rock vanes have successfully “bumped” the flow away from the bank towards the center of the channel. This change can be observed by noting the stream flow patterns in the vicinity of the vanes. Scouring and erosion downstream of the vanes have ceased; instead water velocity in these areas is now minimal, and sedimentation has been enhanced. This change has improved bank stability. The vanes have also enhanced aquatic habitat by creating more hydrologic diversity with the formation of scour pools (at the vane tips) and zones of slow and fast water. The willow poles successfully leafed out and rooted thus providing additional bank protection and visual benefits (see [Fig. 5](#)).



Fig. 5 Stream bank after treatment

BENEFITS AND LESSONS LEARNED:

1. This project demonstrates the use of an effective, environmentally sensitive alternative to bank armoring. The project is a good example of a redirect approach to stream bank repair that preserves the bank line without the need for regrading.
2. The project provided hands-on opportunities for volunteer participation. The work was accomplished by well supervised, volunteer labor including some help from prison inmates in the county sheriff's department.

ADDITIONAL READING:

NCHRP (2005). Environmentally Sensitive Channel and Streambank Protection Measures, NCHRP Report 544. Guidance manual prepared for the Natl. Coop. Hwy. Research Program, Washington, DC.

Bioengineering Case Studies

Sustainable Stream Bank and Slope Stabilization

Goldsmith, W.; Gray, D.; McCullah, J.

2014, XIX, 244 p. 190 illus., 184 illus. in color.,

Hardcover

ISBN: 978-1-4614-7995-6