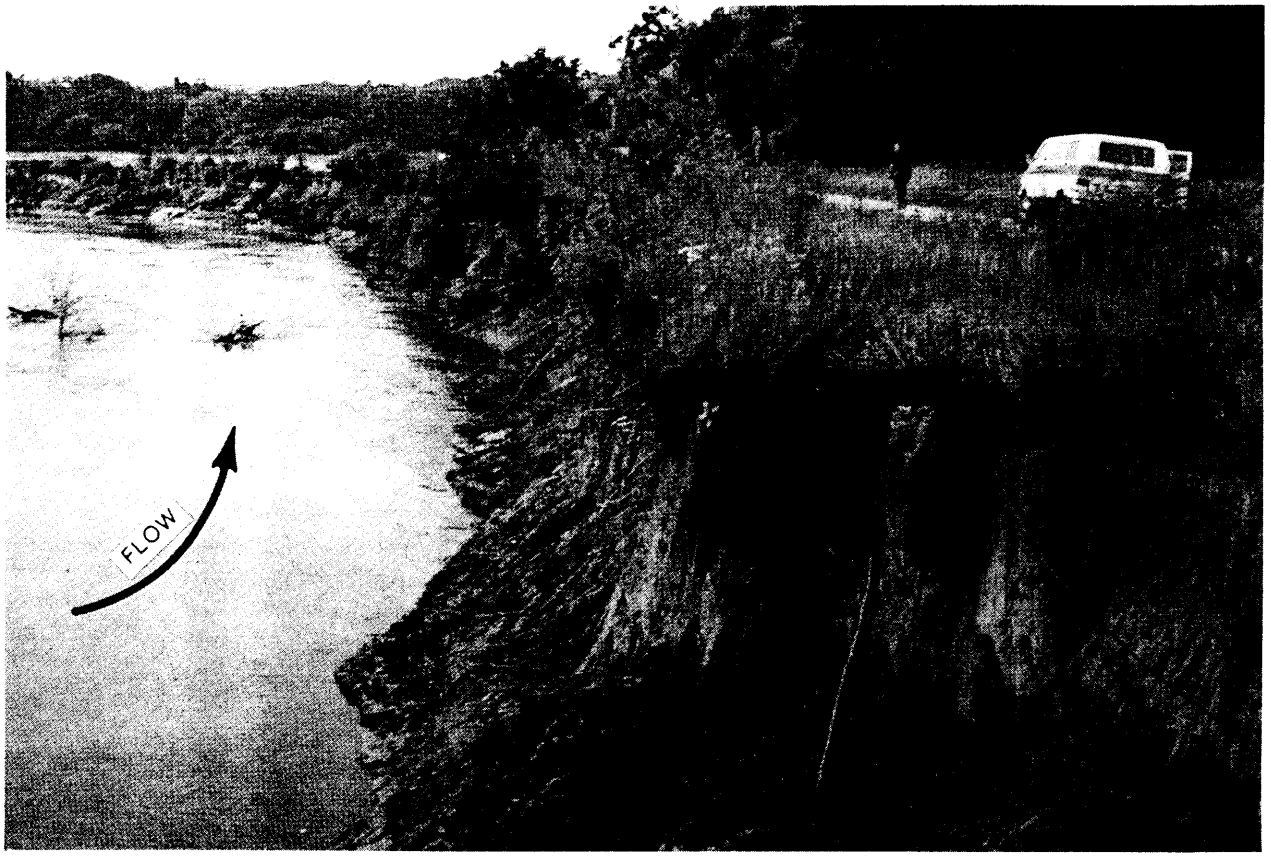
REMR TECHNICAL NOTE HY-MS-1.1

STREAMBANK PROTECTION GUIDELINES



PURPOSE: To describe a plan of action for streambank protection and to identify some of the protection methods available.

DESCRIPTION: The terms "streambank erosion" and "streambank failure" are often used interchangeably to describe the condition of a distressed streambank; however, these terms are entirely different in concept. "Erosion" occurs when individual soil particles at the bank's surface are carried away. Streambank "failure" differs from streambank erosion in that a relatively large section of a bank fails and slides into the channel.

CAUSES: The major causes of stream erosion are: stream current; rainfall; seepage; overbank drainage; obstacles in the stream; wave attack; cycles of freezing and thawing and of wetting and drying; ice and debris; and changes in land use. Whereas the major causes of streambank failure are: swelling of clays due to absorption of water; pressure of groundwater from within the bank;

minor movements of the soil or creep; changes in channel shape due to bed scour or erosion of the bed face; increase of load on top of the bank; and rapid drawdown of water against the bank face. Often several of these causes work in combination to place a streambank in a distressed condition.

DEVELOPING A PLAN OF ACTION FOR STREAMBANK PROTECTION: Streambank protection is a very complex undertaking. There are no engineer manuals available with construction plans for bank protection projects that are guaranteed to work. However, by using an organized approach to deal with a distressed bank problem, the possibility of a fruitless investment of time and money will be greatly reduced. Developing an organized plan of action does not insure that a distressed streambank will be saved, but the chances of success will be improved. Eight basic steps should be followed in developing an organized plan of action for streambank protection:

a. Determine why the streambank is in a distressed condition. In most instances, a healthy streambank receives only a passing glance. However, when a bank becomes distressed and public safety or loss of tangible assets becomes a factor, then the well-being of the bank becomes a concern. Determining why a streambank is in a distressed condition is an essential step in the plan of action. Developing a cure without knowing the cause of a problem may significantly reduce the chances of successfully protecting the bank. (A distressed condition implies that the bank could be suffering surface erosion or total failure due to the collapse or slippage of a large mass of material.)

b. Decide if the bank is worth protecting. Each decision to determine if a bank is worth protecting is unique. Tangible and intangible assets must be weighed against the anticipated costs of proposed solutions and, in some cases, legal and political consequences.

c. Inventory available resources. Once the decision has been made to protect a distressed streambank, an inventory should be conducted to determine what level of group or community cooperation should be expected and to identify available financial, technical, manpower, equipment, and construction material resources. The results of this inventory will determine to a large extent what methods of streambank protection are feasible.

d. Select a bank protection method. The problem and available resources must be matched against a bank protection method that will effectively control further loss of the bank. This is a critical step. An improper match may commit the project to failure before construction is ever started.

e. Develop a project plan. Improper project planning can result in problems during the entire period of construction. Time invested in detailed planning prior to beginning construction will yield dividends throughout the life of the project.

f. Obtain a permit. Any proposed bank protection project requiring soil excavation or fill or a project where a structure is to be built will probably require a permit from the Regulatory Functions Branch of the Corps of Engineers District office having jurisdiction over the stream. In addition, a permit may be required under Section 404 of the Clean Water Act.

g. Construct the project. During construction, timeliness, efficiency, and safety are primary considerations--timeliness in constructing the project when the water is low and the site is accessible; efficiency in arranging for the availability of materials, equipment, and manpower to guard against loss of working time; and proper safety precautions to minimize the chances of accidents.

h. Inspect and maintain the project. It is good policy to initiate periodic inspection of the project soon after construction is completed. Early detection and proper maintenance of a developing problem will not only avoid needless expense and property loss but may eliminate a potential safety hazard.

STREAMBANK PROTECTION METHODS: Many streambank protection methods have been tried over the years, some being very successful and some not so successful. Several of these methods require heavy equipment, costly construction materials, and extensive financial and professional assistance. Further, some approaches to streambank protection may significantly alter the channel such as by forming a scour hole adjacent to a project; thus, allowances must be made in project design plans to accommodate anticipated channel modifications. In spite of these constraints, several approaches to bank protection, both singly and in combination, may be economically feasible. Some of these methods are: (a) bed scour control, (b) vegetation, (c) bank shaping, (d) surface soil stabilizers, (e) riprap, (f) rubble, (g) gabions and wire mattresses, (h) sacks, (i) blocks, (j) used tires, (k) fences, (l) Kellner jacks, (m) bulkheads, and (n) dikes.

ENVIRONMENTAL CONSIDERATIONS: Streambank protection projects impact the environment by affecting terrestrial and aquatic habitat and aesthetics of the project setting. Vegetative clearing of the streambank and placement of a protective structure sometimes destroy valuable riparian wildlife habitat. Structure placement requires removal of snags and other in-stream debris that provide aquatic habitat. These actions can result in uniform hydraulic conditions, thus minimizing aquatic habitat diversity. Aesthetics are important for urban settings and other projects that also will be frequently viewed.

Project design, scheduling, construction, and maintenance are responsible for environmental impacts of a project. Intermittent designs such as jetties or dikes disturb the bank only at the structure, preserving the bank area and vegetation between the structures. Protected, slackwater habitat areas develop between structures for fish use. Structural designs that include covering the bank with materials such as riprap, stone, asphalt, and concrete can be modified to provide for use of vegetation, bank sloping, and structural protection that promotes vegetation establishment on the structure. Nonstructural schemes to protect streambanks include the use of buffer strips along the bank and

restricting access or development (e.g., farming and grazing) of the adjacent floodplain. These schemes similarly preserve wildlife habitat and maintain water quality.

Scheduling of construction activities can reduce impacts on biological resources and promote establishment of vegetation. Consideration should be given to any seasonal peaks in biological activity which are characteristic of some river reaches and nearshore estuarine and coastal areas. Plant propagation activities must be scheduled at a time of the year that will optimize the probability of successful plant establishment. Normally, an optimum time to plant is immediately after seasonal high-water levels recede. Designs that utilize vegetation or encourage invasion by native vegetation should be monitored and maintained after planting until the vegetation is well established.

Construction practices such as the use of floating plants, in channel construction methods, or single-bank construction methods minimize the need for haul roads or clearing for access and equipment. These practices result in preservation of existing wildlife habitat. Maintenance procedures can be modified to allow structures to become vegetated within certain limits, while protecting the structural integrity of the design.

Detailed information on environmentally compatible designs and construction and maintenance procedures is contained in Ref. c.

REFERENCES: a. Streambank protection guidelines for landowners and local governments. M. P. Keown. US Army Engineer Waterways Experiment Station, Vicksburg, MS, Oct 1983.

b. Section 32 Program, streambank erosion control evaluation and demonstration; final report to Congress. Office, Chief of Engineers, Department of the Army, Washington, DC, Dec 1981.

c. Environmental features for streambank protection projects. J. E. Henderson, F. D. Shields. US Army Engineer Waterways Experiment Station, Vicksburg, MS, Dec 1984. Technical Report E-84-11.