

### *Wildflowers in rolls or flats*

Herbaceous plant material can be grown either in flats or, as with sod, in strips that can be cut and rolled. These can be laid out to create an instant herbaceous cover along stream banks. However, the cost of growing the plant material is a limiting factor.

### *Hydroseeding*

Hydroseeding is often used as a cost effective alternative for establishing groundcovers. Where extensive work has been undertaken along a stream, hydroseeding can provide fast cover. In this process, a mixture of water, mulch and seed is sprayed on the surface to be seeded.

### **Caution**

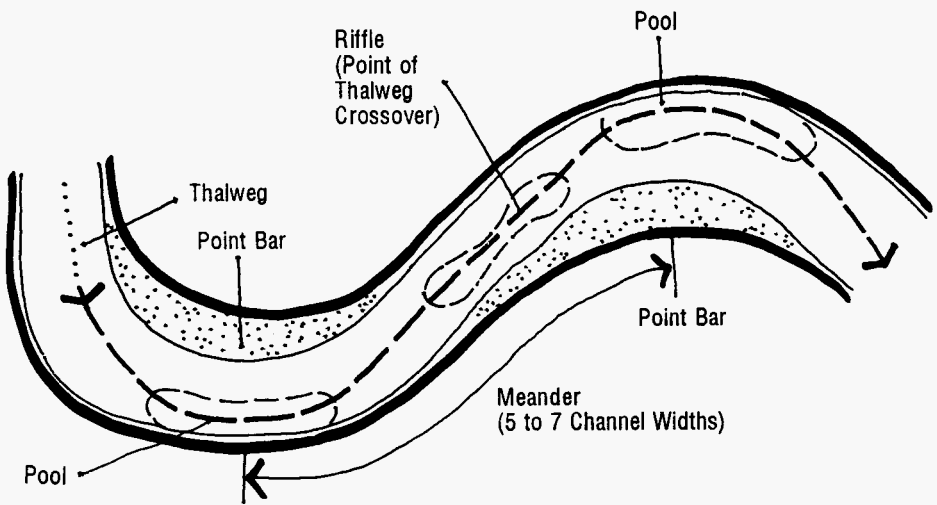
*Most commercial grass and wildflower seed mixtures contain introduced species. To ensure the use of native species, wildflower mats must be custom grown. When hydroseeding, insist on custom seed mixes and identify the native grass and wildflower species to be included.*

## **6.4 RESTORATION TECHNIQUES FOR AQUATIC HABITAT**

### **Restoration of stream channels**

Where a stream channel requires restoration work or must be relocated, natural channel design is the preferred approach. It involves using the natural geomorphological structure of the stream to provide the framework for a range of self-sustaining terrestrial and aquatic communities. Stream channel work will require expert advice. (For further information on natural stream channel design see bibliography or contact the MNR.)





Plan of channel meander (Source: MNR)

## Restoration of fisheries habitat

Permits are required for in-stream or near shore work. The project is usually carried out during the summer to lessen the impact on fisheries and reduce possible flood damage.

Restoration of fisheries habitat may involve correction of bank erosion problems, improvement of water quality and temperature and enhancement of spawning areas, as well as juvenile and adult habitat. It is important to determine whether erosion is active and accelerated as opposed to "natural", and whether or not it requires remedial measures. Consult an expert who can carry out simple checks, including width/depth ratio measurements and extent of point bar formation (a process of deposition that may offset the erosion on the opposite bank).



Placement of boulders can protect eroding banks from the force of the flowing water. Channel deflectors can be installed to reduce bank erosion.

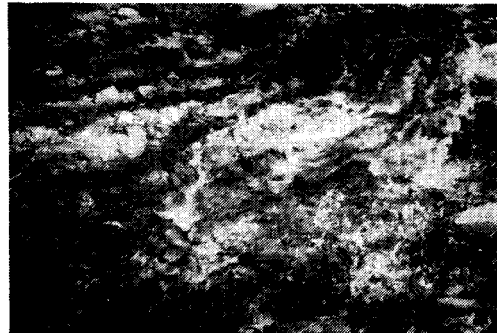
## Caution

*Gabions, ledge rock, and riprap have been overused in the past and have led to the removal of in-stream and riparian habitat. These erosion control measures can result in the erosive energy being transmitted downstream, where more erosion occurs. To minimize downstream impacts, use different sized rocks and stagger placement as much as possible.*

In many cases cabling logs in an artificial logjam or incorporating them into rock placements may be preferable. Root wads can be installed in the stream bank to reduce the erosive force of the water.

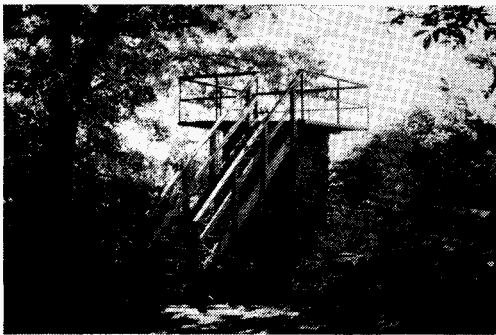
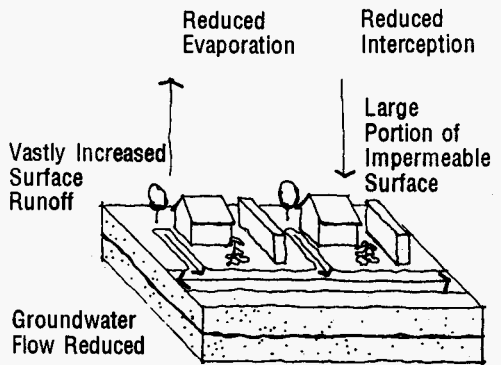
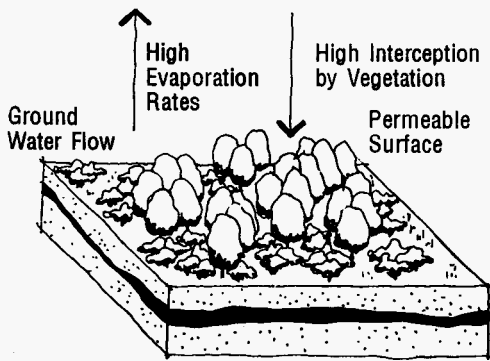


Fallen trees and branches can alter the flow of the stream, create pools, and provide shade. Careful placements of rocks, trees and limbs can enhance pool and riffle sequences. Gravel bars, ledges and overhanging vegetation can be installed to improve spawning habitat. Detritus provides food sources for aquatic organisms.



## Restoration of the riparian zone

The key to restoring these habitats is determining the cause of impacts and then devising a strategy to address them. One of the greatest negative factors affecting streams and their associated riparian habitat is the amount of hardened surface in the watershed. When about 15% of a watershed is impervious, cold water streams become warm due to decreased groundwater infiltration and increased runoff from roofs, parking lots, etc. When 25% is impervious, stream integrity begins to decline. Higher peak flows result in erosion, the stream widens and becomes very shallow during low flows, pools and riffles are lost and the substrate becomes finer. Nutrient concentrations increase and pollution intolerant species of invertebrates and fish disappear.



Riparian zones are sometimes degraded due to indiscriminate access. Trampling of vegetation along a stream results in bank erosion. In urban areas, finding effective methods to limit human encroachment must precede any restoration effort. It is important to create access points in less sensitive locations and to design access structures that limit damage to

the natural environment. Dense, shrubby vegetation can be used to protect sensitive and erosion-prone areas from human access.

In rural areas, where cattle have access to streams for drinking, fencing and an alternate source for drinking water may be required.

Where riparian planting is included with stream channel work, the techniques for establishing plant material may need to be adapted. As noted above, such work is usually carried out during the summer when the success of bioengineering techniques may be more limited than it would be in spring or fall.

## **6.5 PONDS IN A STREAM SYSTEM**

The presence of ponds may affect the water quality and temperature of streams. Both natural and man-made ponds provide habitat for wildlife. Cold water fisheries, however, are often adversely affected by the rise in water temperature down-stream from a pond. In urban areas, stormwater ponds provide water quality improvements, i.e., reductions in sediments and contaminants, but unless they are appropriately designed, they, too, can release large quantities of water and affect water temperatures. (Further information on stormwater ponds is given in Section 8.)

Small streamside pools and former oxbows provide vital amphibian habitat, for example for frogs and salamanders.

Creation of isolated ponds in riparian zones can greatly enhance habitat for aquatic plants and wildlife as well. By separating such ponds from the stream, adverse effects on fish habitat are avoided, and amphibians can avoid predation by fish. In the floodplain of cold water streams, care should be taken to ensure that created ponds will not intercept groundwater discharging to the stream.



Techniques for creating ponds or wetlands in riparian habitat are discussed in Sub-section 3.4.



Newly constructed pond



Finished pond habitat

## 6.6 MANAGEMENT

The management of riparian zone restoration projects is likely to focus on controlling problems that have been identified by the monitoring program. This may involve replanting in some areas, or adding further erosion control techniques in others. Monitoring may also reveal other opportunities for restoration, or that the initial work has not achieved the desired objectives. In these situations it may be necessary to reevaluate objectives and initiate further management measures.

## 6.7 MONITORING

Both the aquatic and terrestrial components of stream corridors should be monitored. The former can be very complex, as it involves water quality, water temperature and biotic components, such as stream-bottom organisms and migratory and resident fish populations. Water temperature and quality (i.e., suspended solids, turbidity, dissolved organic carbon, particulate organic matter, dissolved oxygen, nutrients [TKN, phosphorus]) and contaminants (lead, zinc, fecal coliforms) have direct implications for fisheries.

For each of these components, baseline data should be collected prior to undertaking restoration work. As the restoration proceeds and matures, its effect can be measured. Stream flow and volume data are often collected as part of flood control studies and may not have to be compiled as part of the monitoring of restoration efforts.

Where stream bank erosion has been a concern, restored areas should be closely monitored during spring floods and fall storm events, particularly during the establishment phase of the plant material. If problems arise, remedial measures should be taken as soon as possible so as to correct them prior to the next flood. Erosion of valley banks should also be monitored and remedial measures implemented as required. New planting should be evaluated to determine success rates and to assess the need for maintenance.

### *Selected References*

---

Commonwealth of Pennsylvania, 1986. *A Streambank Stabilization and Management Guide for Pennsylvania Landowners*. Department of Environmental Resources.

Gray, Donald H., and Andrew T. Leiser, 1989. *Biotechnical slope protection and erosion control*. Robert E. Krieger Publishing Co., Inc., Malbar, Florida.

Shrubcole, D., Ed. 1994. *"Natural" Channel Design: Perspectives and Practice. Proceedings of the First International Conference on Guidelines for "Natural" Channel Systems*. Niagara Falls, Ontario.

Ministry of Natural Resources, June 1994. *Natural Channel Systems: An Approach to Management and Design*. Province of Ontario.