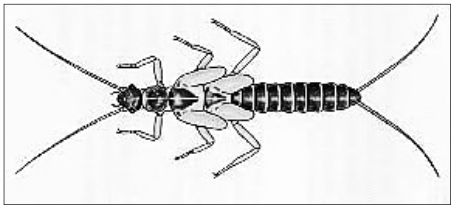
3.0 DITCHES

Insects that are indicators of excellent water quality and provide nutrition for stream trout

Stonefly Nymphs
Slender Winter Stonefly Nymph
Order Plecoptera, Family Capniidae



- ❑ Measures up to 1/2 inch in length (not including tails)
- ❑ 2 tails
- ❑ 2 sets of wing pads (occasionally absent)
- ❑ Small, slender and cylindrical
- ❑ Often darkly colored
- ❑ Habitat ranges from small springs to medium-sized streams. Nymphs are often found among decaying leaves on which they feed.

Great Lakes Trivia Test (answers on back):

1) How long is the shoreline of the Great Lakes (Canadian and U.S. coastlines combined)?

2) What is the nutrient that caused excessive algae in the Great Lakes and led to the "death" of Lake Erie?

3) Name three of the four places that Great Lakes toxics come from.

4) The Great Lakes make up what percent of the world's surface freshwater supply?

5) The Great Lakes make up what percent of our nation's surface freshwater supply?

GUIDING PRINCIPLES

1. Plan projects. (All projects should be planned!)
2. Move water off road surfaces as soon as possible.
3. **Direct runoff into vegetated filter areas or rock-lined turnouts.**
4. Address road runoff from the top of both approaches.
5. Avoid directing runoff into surface waters.
6. Stabilize bare areas.
7. **Keep runoff velocities low and avoid concentrating runoff.**
8. Minimize areas of disturbance.
9. Revegetate disturbed areas ASAP.
10. Maintain and monitor all practices.

Answers:

1) 9400 miles
2) phosphorus
3) land (through rainwater runoff), direct discharges, releases from bottom sediments, and the air (atmosphere)
4) 20 percent
5) 90 percent

3.0 DITCHES

3.1 Purpose

Ditches are constructed to convey water from storm runoff to an adequate outlet without causing erosion or sedimentation. A good ditch needs to be shaped and lined using the appropriate vegetative or structural material.

3.2 Importance to Maintenance & Water Quality

Efficient removal of runoff from the road will help preserve the road bed and banks. Well designed ditches provide an opportunity for sediments and other pollutants to be removed from runoff water before it enters surface waters. Achieve this by controlling, slowing and filtering the water through vegetation or structures. In addition, a ditch must be stable so as not to become an erosion problem itself.

3.3 Ditch Profile and Grading

Correct profile and grading techniques will remove water efficiently, decrease erosion, and increase the length of time between cleaning and regrading, thereby cutting maintenance costs. The preferred equipment for creating ditches is a rubber-tired excavator with an articulated bucket.

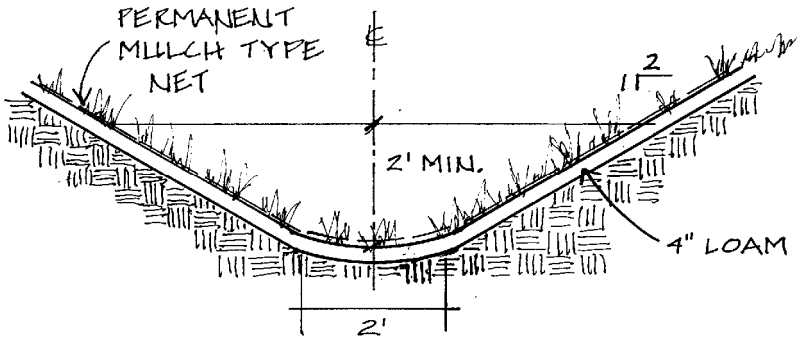


Figure 2—GRASS LINED DITCH

- Locate ditches on the up slope side of the road to prevent water from flowing onto the road from uphill.
- Size ditches so they are large enough to handle runoff from the drainage area.
- Design and grade ditch and bank side slopes at a maximum 2:1 slope.

- Excavate a ditch deep enough to drain the road base: 1-1/2 - 2 feet deep.
- The ditch bottom should be parabolic-shaped or at least flat and a minimum of 2 feet wide to help slow and disperse water.
- Line ditches which has a less than 5% slope with grass in order to filter sediments.
- Line ditches which have a greater than 5% slope with rock riprap.
- If rock lining is used, underlay the lining with geotextile (porous material).
- All ditches need an outlet; standing water weakens roads (see outlets for construction techniques, Section 5.0).

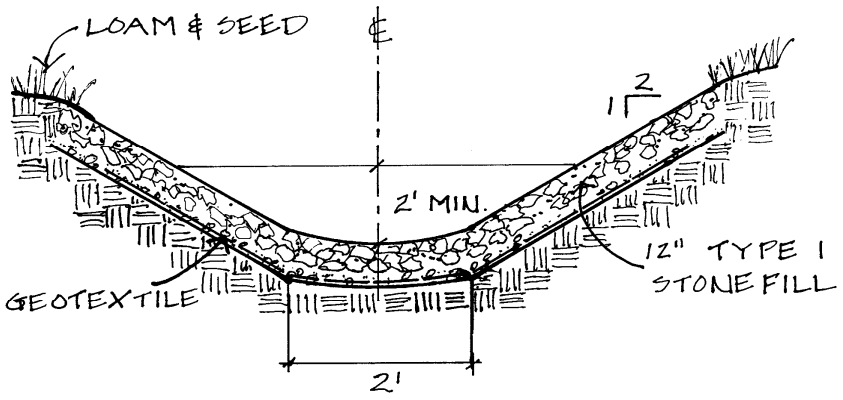


Figure 3—STONE LINED DITCH

Table 1 - DITCH LININGS		
Channel Slope	**Lining**	**Thickness**
0 - 5%	Grass	
5 - 10%	D50 - 4 inch (2 - 6 inch) diameter rock	7.5 inch
> 10%	D50 - 6 inch (3 - 12 inch) diameter rock	12 inch

3.4 Cleaning & Maintenance

Well designed ditches can be cleaned making maintenance quicker and easier.

- Clean ditches when they become clogged with sediments or debris to prevent overflows and washouts.
- Check ditches after major storm events for obstructions, erosion, or bank collapse.
- Regrade ditches only when absolutely necessary and line with vegetation or stone as soon as possible.

3.5 Diversion Ditches and Berms

Use diversion ditches and berms to intercept, consolidate, and direct runoff.

- Locate at the top of a slope to prevent erosion such as gullies and rills on the slope; may also be used across a slope to break up the length of the slope or to redirect water flow.
- Locate diversion ditches and berms where they will empty into stable disposal areas to collect sediments.
- May use a combination of a ditch and a berm or mound of earth or stone in areas where runoff is hard to control or when constructed on a slope.
- Design and line diversion ditches the same as other ditches.

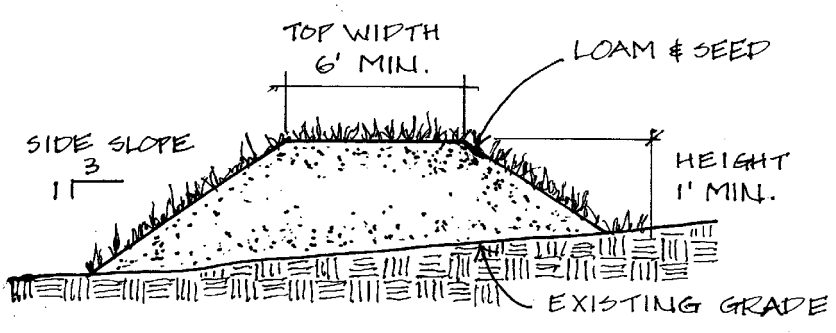


Figure 4—DIVERSION BERM

3.6 Velocity Controls & Energy Dissipaters

Velocity controls and energy dissipaters reduce erosion by preventing scouring of ditches and culvert beds and outlets. They are used to slow the water flowing through ditches and culverts. They also collect sediment and help ground water recharge. They are also a means of keeping brush, trash, and other debris from reaching culverts and becoming lodged inside.

- Locate in ditch channel or near culvert outlet.
- Construct dikes no higher than 1/2 the channel depth.

- Extend the ends of the velocity controls and energy dissapaters above the expected flow depth on the bank.
- Always provide channel bottom protection downstream from a velocity control.

Table 2-VELOCITY CONTROLS AND ENERGY DISSIPATERS		
Type	**Duration**	**Comments**
Stone Dike	Permanent	Most effective method. Can be used with concentrated flows. Maintenance is still required for this application.
Straw Bale Dike*	Short term (≤ 1 month)	Only to be used short term or during construction. Bales must be anchored in soil and changed frequently. Not for use with concentrated flows.
Silt Fence*	Short term (≤ 1 month)	Only to be used short term or during construction. Not for use with concentrated flows.
Logs and Brush*	Short term (≤ 2 weeks)	Only to be used short term or during construction. Not for use with concentrated flows.

* Use of short term velocity controls (straw bale dike, silt fence, and logs and brush) have very limited application due to their temporary nature. They required a high level of maintenance and may cause further erosion of not properly maintained.

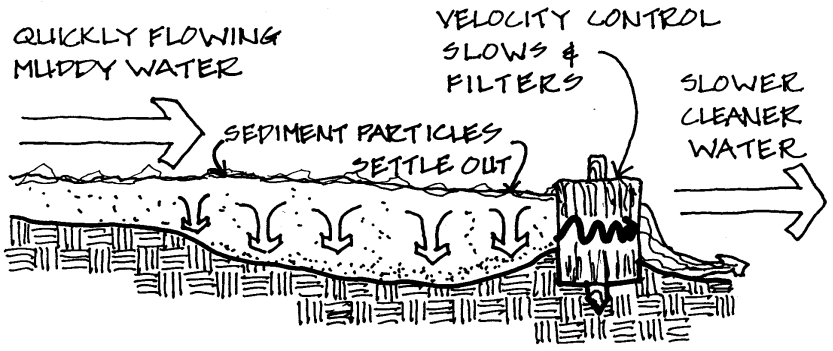


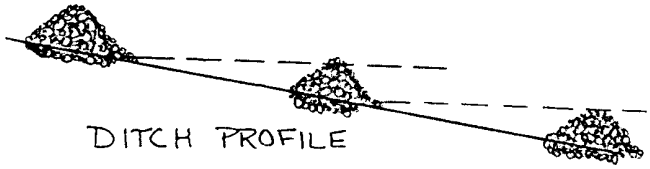
Figure 5—VELOCITY CONTROL

Types of velocity controls and energy dissipaters include:

3.6.1 Stone Dikes

Stone dikes are more permanent than most other types of controls. They are easy to install and can be easily expanded if necessary.

- Construct dikes of stone large enough to handle the expected velocity of water, but…
- The smaller the stone size the more sediment is removed.



Place top of downslope dike at or above same elevation as bottom of dike immediately upslope.

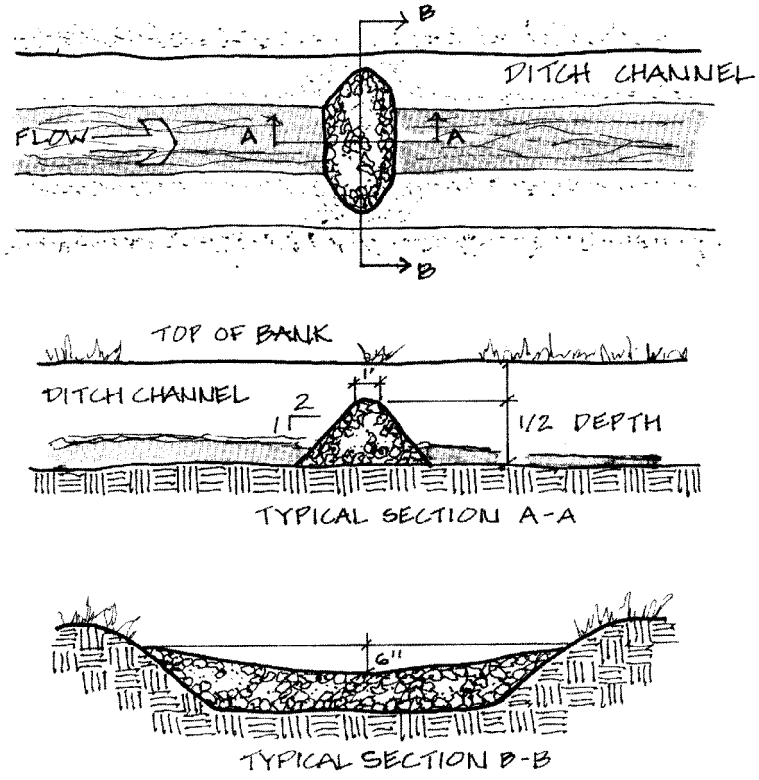


Figure 6—STONE DIKES

3.6.2 Straw Bale Dikes

Straw bale dikes are temporary dike structures since straw bales will rot. They may redirect water rather than detain it. The installation technique is critical to proper functioning of the dike. Periodic removal of trapped sediment is necessary for optimum performance. They also have the potential to introduce undesirable plant species.

- Construct with straw bales tightly butted together, embedded 4 inches into the ground and staked; ends of straw bales should be higher than centers such that water will spill over the top of the bales, not around the sides.
- Use in smaller ditches to slow water flow and at the toe of a slope to trap sediment.
- Remove sediment from behind bales when it is within 3 inches of the top of the bale.
- Do not use in concentrated flows.
- Replace bales frequently (when plugged).
- They are a less preferred option than rock check dams because of frequent maintenance.

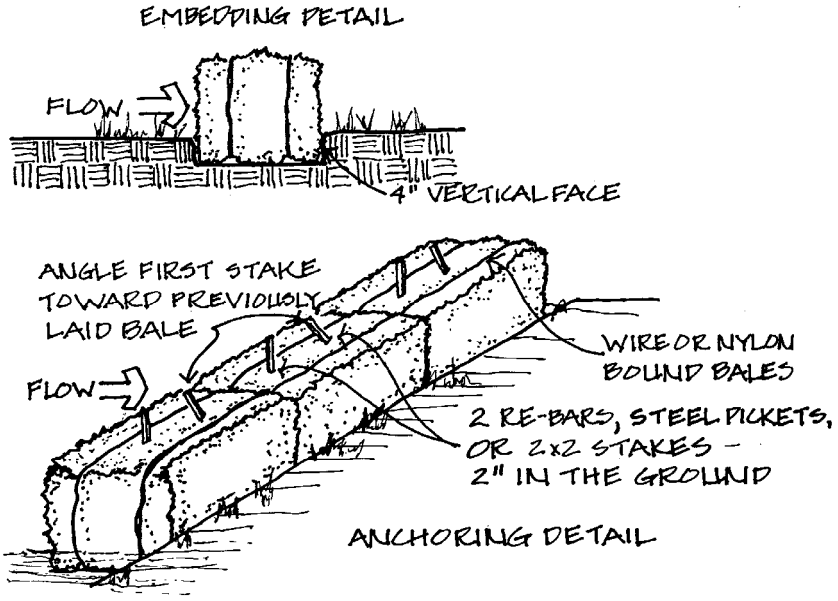
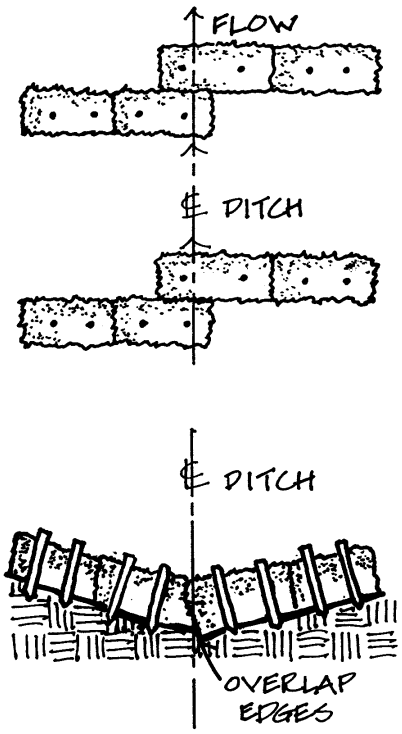


Figure 7—STRAW BALE DIKES

TYPE A

TO BE USED AT THE BASE OF A SLOPE OR IN AREAS WHERE THE EXISTING GROUND SLOPES AWAY FROM THE TOE OF THE FILLED EMBANKMENT



TYPE B

TO BE USED IN DITCHES OR IN AREAS WHERE THE EXISTING GROUND SLOPES IN TOWARD THE FILLED EMBANKMENT

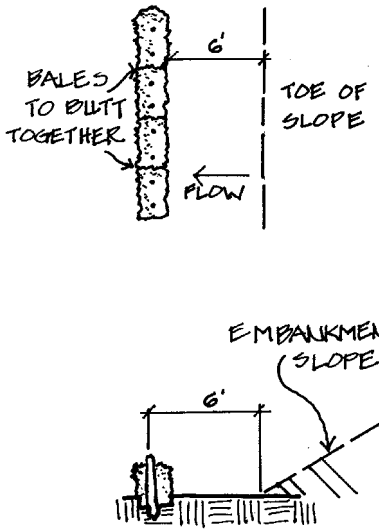


Figure 8—STRAW BALE DIKES

3.6.3 Silt Fences

Silt fences are temporary controls that have the advantage of being lightweight, portable, and often reusable. They can last up to a month. They may redirect water rather than detain it, but can detain great quantities of sediment.

- Install a pervious geotextile fabric with steel or wood posts.
- Use in ditches to slow water flow and at the toe of a slope to trap sediment.
- Install an imaginary contour line and turn both ends upgrade to filter all water and prevent flow around the ends.
- Periodic removal of trapped sediment is necessary for optimum performance.
- They are much less desirable than rock check dams when installed perpendicular to the water flow.

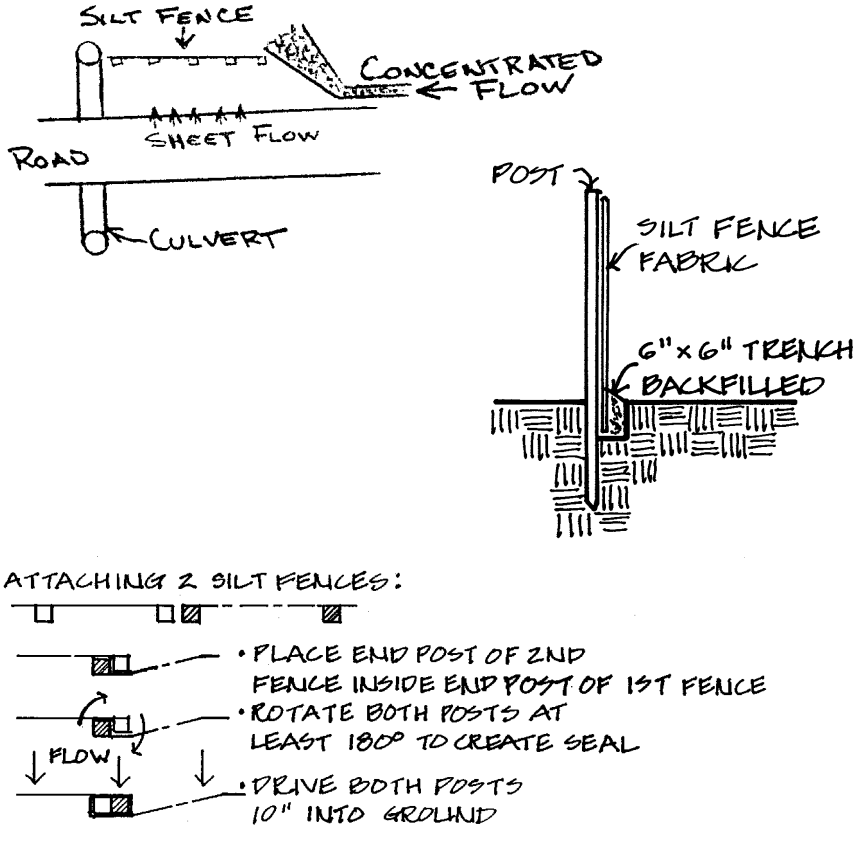


Figure 9—SILT FENCE DIKES

3.6.4 Log and Brush Check Dams

Log and brush check dams are good emergency controls (short term) because the materials for these dams can be gathered on site, also making them convenient and inexpensive. However, the installation technique is critical to performance and they are difficult to remove and repair. Long term use can cause flooding.

- Construct of brush intermeshed with logs staked into the ground.
- Remove when finished.
- Replace with rock check dams if long term use is necessary.

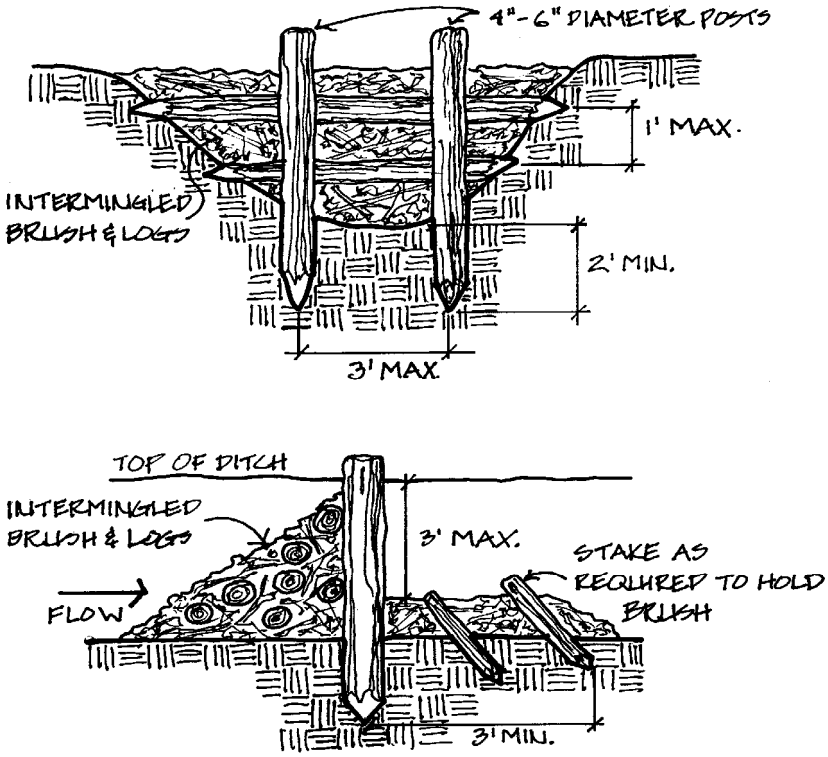


Figure 10—LOG & BRUSH CHECK DAMS

3.6.5 Buffer Zones

Buffer zones are undisturbed vegetated areas that separate roads, development, or construction sites from sensitive areas such as streams, wetlands, and lakes. If there is no vegetation between the road and stream, it would be beneficial to plant grass, shrubs, and/or trees. Assistance can be obtained from the Natural Resources Conservation Service and area Soil Conservation Districts including the purchase of plant materials. Buffer zones:

- Slow water by overland flow through vegetation
- Act as a natural sediment filter
- Do not require much maintenance
- Keep water cool
- Take up nutrients, toxins, and other potential pollutants
- Provide energy for biotic communities (leaf litter)
- Preferred method of slowing and filtering water before it enters surface waters
- Visual buffers
- Wildlife habitat

Table 3 - BUFFER STRIP WIDTHS	
SLOPE OF LAND ABOVE WATER BODY OR STREAM (%)	**MINIMUM WIDTH OF STRIP (FEET)**
0 - 10	100
10 - 20	115
20 - 30	135
30 - 40	155
40 - 50	175
50+ Activity may not be advisable due to erosion potential. Extreme care must be taken to prevent movement of soil.	

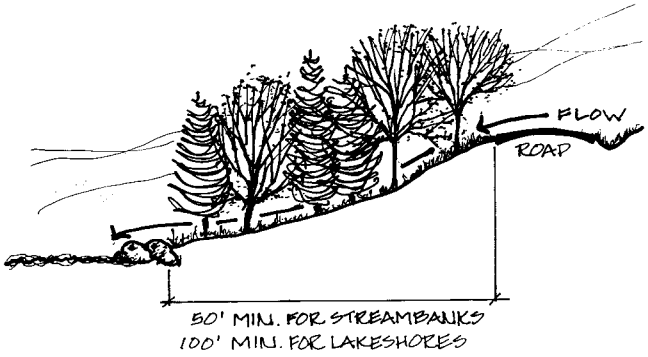


Figure 11—BUFFER ZONE