

NATURAL RESOURCES CONSERVATION SERVICE
ILLINOIS URBAN MANUAL
PRACTICE STANDARD

Grass-Lined Channel

(acres)

Code 840



Source: NC Erosion and Sediment Control Field Manual

Definition

A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation for stable conveyance of runoff.

Purpose

The purpose of this practice is to convey and dispose of concentrated surface runoff without damage from erosion, deposition, or flooding.

Conditions Where Practice Applies

This practice applies to construction sites and developing areas where:

1. Concentrated runoff will cause damage from erosion or flooding
2. Sufficient depth of soil materials is present to allow establishment of vegetation that will stabilize the cross section and grade of the channel
3. Slopes are generally less than 5%

4. Space is available for a relatively large cross section

Typical uses include roadside ditches, channels at property boundaries, outlets for diversions, and other channels and drainage of low areas.

Criteria

Capacity – As a minimum, grass-lined channels shall carry the peak runoff from the 10-year frequency, 24-hour duration storm. Where flood hazard exists, increase the capacity according to the potential damage. For grass-lined channels with a grade of less than 1 percent, out-of-bank flow may be permitted if such flow will not cause erosion, property or flooding damage. The minimum channel capacity in such cases shall be a 2-year frequency storm. Channel dimensions may be determined by using design tables with appropriate retarding factors or by Manning's formula using an appropriate "n" value. When retarding factors are used, the capacity may be based on "C" retardance and stability on "E" retardance, where the waterway will be regularly mowed and otherwise maintained.

Velocity – The maximum permissible velocities of flow shall not exceed the values shown in Table 1.

Cross-Section – The channel shape may be parabolic, trapezoidal, or V-shaped, depending on the need and site conditions. The design water surface elevation of a grass-lined channel receiving water from diversions or other tributary channels shall be equal to or less than the design water surface elevation in the diversion or other tributary channels. The parabolic shape is the preferred cross section. The triangular cross-section concentrates flow in the "v" of the channel causing higher and more erosive velocities.

When vegetated triangular channels are used, the minimum side slopes should be 6:1 or flatter.

Drainage – Base flow shall be handled by a stone lined center, subsurface drain, or other suitable means since sustained wetness usually prevents adequate vegetative cover. The cross-sectional area of the stone lined center or subsurface drain size to be provided shall accommodate a flow rate of 0.1 cfs/acre or by actual maximum base flow.

Where tile is used along the channel, it should be located as close to $\frac{1}{3}$ of the channel (top) width from the center of the waterway as practical. The top of the tile should be at least 2.0 feet (up to 4 feet, where possible) below the bottom of the channel, except where soil or outlet conditions make this depth unpractical. The tile shall meet the requirements shown in the Practice Standard [SUBSURFACE DRAIN 945](#).

Alignment – Minor changes may be made to improve alignment. Care must be taken to avoid exposing soil materials (such as sodium soils or high clay content glacial till subsoil) that are not conducive to the establishment and maintenance of adequate vegetative cover.

Outlets – All grass-lined channels shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. Appropriate measures must be taken to dissipate the energy of the flow to prevent scouring of the outlet channel. Examples of acceptable outlets include but are not limited to [GRASS-LINED CHANNEL 840](#), [IMPOUNDMENT STRUCTURE – FULL FLOW 841](#), [IMPOUNDMENT STRUCTURE – ROUTED 842](#), [INFILTRATION TRENCH 847](#), [LEVEL SPREADER 870](#), and [ROCK OUTLET PROTECTION 910](#).

Establishment of Vegetation – Grass-lined channels shall be vegetated according to the Practice Standard [PERMANENT VEGETATION 880](#).

Side Slopes – Side slopes shall not be steeper than a ratio of 2 horizontal to 1 vertical. They should be designed to accommodate the equipment used for maintenance. Where planned to be crossed by large equipment, trapezoidal channels shall have side slopes of 8:1 or flatter and be protected according to the Practice Standard [STABILIZED CONSTRUCTION ENTRANCE 930](#). When triangular (V-shaped) channels are used, the minimum side slopes should be 6:1 or flatter.

Sedimentation Protection – Protect permanent grass-lined channels from sediment produced in the watershed, especially during the construction period. This can be accomplished by the effective use of diversions, sediment traps, protected side inlets and vegetative filter strips along the channel.

Construction – The grass-lined channel will be constructed meeting the requirements of Construction Specification [DIVERSIONS AND WATERWAYS 27](#).

Considerations

Generally, channels should be located to conform with and use the natural drainage system. Channels may also be needed along development boundaries, roadways, and back lot lines. In all situations channels should be located so that they do not make sharp, unnatural changes in direction or grade of flow. Avoid channels crossing watershed boundaries or ridges.

Major reconfiguration of the drainage system often entails increased maintenance and risk of failure.

Establishment of a dense, erosion resistant vegetation is essential. Construct and vegetate grass-lined channels early in the construction schedule before grading and paving increase the rate of runoff.

All grass-lined channels should be designed to permit easy crossing of equipment during construction and maintenance.

If local ordinances permit, storm sewers may be used to extend existing agricultural tile or base flow across a development. They may also be used as an under drain for the channel if the conduit is open jointed.

Geotextile fabrics or special mulch protection such as fiberglass roving or straw and netting provide stability until the vegetation is fully established. It may also be necessary to divert water from the channel until vegetation is established or to line the channel with sod. Rock checks or filter fabric checks may also be needed to protect the channel before vegetation is established. Sediment traps may be needed at channel inlets and outlets.

Applicable state drainage laws, traditional case law precedent and local ordinances and regulations must be observed in locating grass-lined channels.

Plans and Specifications

Plans and specifications for installing grass-lined channels shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum include the following items:

1. Channel location and alignment
2. Grade, depth and width
3. Channel cross section type
4. Seeding specifications and dates
5. Subsurface drainage, if needed

All plans shall include the installation, inspection, and maintenance schedules with the responsible party identified.

The grass-lined channel will be constructed meeting the requirements of Construction Specification [DIVERSIONS AND WATERWAYS 27](#). Standard Drawings [WATERWAY PLAN – PARABOLIC IL-540P](#), [TRAPEZOIDAL IL-540T](#), or [V BOTTOM IL-540V](#) may be used as the plan sheet.

Operation and Maintenance

During the establishment period, inspect grass-lined channels after every rainfall. After grass is established, check the channel at regular intervals and after every heavy rainfall event. Immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes. Removal all significant sediment accumulations to maintain the designated carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.

Table 1
Permissible Velocities for Channels Lined with Vegetation

Channel Slope (%)	Lining	Permissible Velocity (ft/sec)¹
0 – 5	Tall fescue	5
	Kentucky bluegrass	
	Smooth bromegrass	
	Grass-legume mixture	4
	Red fescue	3
Redtop		
5 – 10	Small grains ²	2.5
	Tall fescue	5
	Kentucky bluegrass	4
	Smooth bromegrass	
	Greater than 10	Grass-legume mixture
Tall fescue		3
Kentucky bluegrass		
	Smooth bromegrass	

¹For highly erodible soils, permissible velocities should be decreased 25%. An erodibility factor (K) greater than 0.35 would indicate a highly erodible soil. Erodibility factors (K-factors) for Illinois soils are available in every NRCS office.

²For temporary seedings