

Departments of Agronomy MF-1064
and Biological and Agricultural Engineering

Conservation Farming

Grass waterways and terraces are important components of a sound soil and water conservation plan. Many grass waterways have been constructed as part of federally funded programs and represent a significant financial investment by both the landowner and by the public. This publication provides guidance on how to best manage waterways so that they can continue safely discharging runoff water, reducing erosion, and contributing to better water quality in the watershed for many years.

Grassed waterways play an important role in improving water quality. Prevention of gully erosion is the primary contribution, but grassed waterways also intercept pollutants leaving the field. The design, however, is for the safe and rapid transport of water, not for the shallow sheet flow necessary to effectively intercept pollutants. Because waterways are a flow way for excess runoff, nutrient and pesticide applications within their boundaries must be carefully managed to avoid movement of pollutants directly to surface water. Note that waterways are only one component of a conservation system that includes terraces, conservation tillage, and nutrient and pest management. A well-designed and maintained soil conservation system helps sustain productivity while providing clean water to the watershed.

Variations in Waterway Design

Waterways often serve as outlets for runoff from terraces. Terraces intercept runoff water caused by heavy rains and route this excess water off fields at a safe velocity. In the terrace channel, water is slowed and directed to a stable outlet, such as a waterway. The wide, shallow, sod-lined waterway then safely transports water off the field, preventing gully formation.

Waterways may be used without terraces and can compliment a reduced-tillage management system such as ridge-till. On highly sloped fields, ridge-till furrows can be oriented to drain directly into the

waterway, running perpendicular to the field slope. Ridges and furrows should be placed on a gradient sufficient to carry water, while minimizing erosion or overtopping of ridges. If terraces are present and slopes are low, then the furrows can be oriented to drain into terraces, allowing the terraces to transport excess water to the waterway.

For waterways to function properly, follow these steps:

- Construct waterways according to Natural Resources Conservation Service specifications.
- Apply lime, nitrogen, phosphorus, and potassium according to soil test recommendations and yield expectation.
- Plant grass that is adapted to the soil type and climate.
- Manage for maximum water-carrying capacity and production of forage and/or seed.
- Perform routine inspections and maintenance.

Check with the Natural Resources Conservation Service for design specifications. Properly constructed and well-maintained waterways can be expected to function effectively for decades.

Selecting Adapted Grasses

The most frequently used grass for waterways in Kansas is smooth brome grass. In southeastern Kansas, tall fescue is commonly used. Seek assistance from your local K-State Research and Extension agriculture agent or the district conservationist about which species is most appropriate for your situation and will provide a



The primary purpose of a waterway is to provide a stable outlet for runoff. Primarily, maintenance consists of mowing, but may also include haying, seed production, and careful grazing. Manage to promote a vigorous, dense sod, and minimize extra maintenance needs. (Photo courtesy of USDA NRCS.)

stable cover for the waterway. Smooth brome grass can be established quickly and has a dense, fibrous root system that resists erosion. Native species, once established, provide excellent cover although more time is required for native grass to develop into a dense sod.

Fertilization and Liming of Waterways

The primary purpose of a good fertilization program is to ensure that waterway grasses grow vigorously and maintain a dense, tough, non-erodible sod. Soil testing is an integral part of establishing waterways. Soils should be limed and fertilized according to soil test recommendations. In areas where the subsoil is exposed during construction, a onetime application of manure is a good way to build organic matter and provide nutrients. Any amendments should be well incorporated before seeding. Once established, waterways require annual maintenance. For stand maintenance of cool season grasses, an annual application of 30 to 40 pounds of nitrogen per acre is recommended. Nitrogen should be applied between late November and mid-March. Higher nitrogen rates will be necessary when managed for hay or seed production.

If seed production is desired, nitrogen fertilizer should be applied before soil freezing in November or December. On soils low in phosphorus (P) or potassium (K), an application of these nutrients, according to soil test recommendations, should be included. Soil tests should be conducted every 3 to 4 years on established waterways to monitor soil pH, P, and K levels. Needed phosphorus and potassium can be applied at the same time as nitrogen fertilization. If lime is needed on established waterways, apply no more than 2,000 pounds ECC/a (effective calcium carbonate per acre).

Routine Inspections and Maintenance

Waterways should be inspected at least annually and, if possible, after each heavy rain. When problems develop, perform needed maintenance promptly to prevent additional, costly damage to the waterway. Abuse and neglect are the most common causes of waterway failure. Common maintenance problems include weeds and brush, eroded spots, sediment deposits, bare spots, and insufficient grass stands. Maintenance activities may be needed more frequently when the waterway handles a large volume of water or is on a steep slope.

A vigorous grass stand, routine mowing, and a well-balanced fertilization program will help the grass compete with weeds and brush. Weeds and brush also can be controlled by cutting, grazing, or herbicide use. The current issue of the K-State Research and Exten-

sion bulletin *Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland* (issued annually) has recommendations on herbicide use. Avoid herbicides with a high potential for runoff. Herbicides used on adjacent cropland may harm grass stands when transported in runoff water or attached to sediment. Damage also can occur when the sprayer is not turned off while crossing waterways.

Waterway maintenance includes mowing. Timely mowing provides an even growth of grass in the spring and minimizes sediment buildup where terraces connect to the waterway. Frequent mowing or shredding can prevent smothering without removing the clippings. Some grasses, such as fescue, tend to become clumpy when mowed infrequently. Grass clumps can concentrate water flow, causing erosion and creating channels.

Gully formation is the most serious problem in a waterway. It is usually caused by poor management, sediment deposits, using the waterway as a roadway or livestock trail, or by an unstable outlet. Eroded spots should be filled promptly, compacted, and reseeded or sodded. Slight overfilling allows settling. Reseeding perennial grasses with annuals such as wheat, oats, rye, or annual ryegrass will help ensure that good cover is quickly re-established. During grass establishment, divert runoff by use of silt fences or by low elevation earth berms. For unstable outlets, grade stabilization structures may be necessary. Minimize machine travel within waterways, especially when the soil is wet or soft. Try to limit traffic within the waterway, using the sides, or berms to drive.

Sediment accumulation results from insufficient water velocity and is most common where water from terraces discharges into the waterway. Sediment deposits should be removed promptly, because they tend to increase with subsequent runoff events, eventually blocking the waterway. In severe cases, reshaping and reseeding the waterway may be the best option for restoring waterway capacity. Reseeding grass in a waterway may be necessary in cases of initial establishment problems, smothering from lodged growth or improper mowing, sedimentation, weed and brush competition or herbicide damage. For limited sized areas, reseeding can be enhanced by mulching and slight overfilling of reseeded areas. Before reseeding, correct nutrient or soil pH deficiencies and perform any other maintenance. Sometimes temporary dikes constructed at terrace outlets are necessary to protect reseeded areas from runoff.

Managing for Production

Waterways not only serve to route excess runoff safely to streams, but they also can be a source of income. Grassed waterways frequently lie within productive soils and by design receive a greater proportion of precipitation than the fields they drain. Waterways can provide protein rich forage for grazing or haying, or they can be managed for seed production. A good fertility program can increase production of forage and/or seed. Well-fertilized waterways can provide high protein forage that helps balance the ration when crop residue is grazed in the fall.

Annual haying is an excellent management practice. With adequate fertility and timely cutting, waterways can provide high-quality forage. Cutting height should not be less than 3 to 4 inches. To maximize quality and quantity, fescue hay should be made in the early boot stage, and brome should be hayed in full bloom. Consult K-State Research and Extension publication *Smooth Brome Production and Utilization*, C-402 or *Soil Test Interpretations and Fertilizer Recommendations*, MF-2586, for specific management recommendations.

Keeping the waterway clear prevents the slowing of water and reduces the sediment accumulation. Any harvested hay should be quickly removed to prevent smothering of vegetation. However, harvest only when the waterway is firm enough to prevent wheel ruts. If the soil is too wet for traffic, postpone harvest to prevent damage to the waterway. This may reduce hay quality, but protecting the waterway structure is more important.

Waterways also can provide excellent seed production. After the seed is harvested, the remaining grasses should be hayed or mowed and clippings removed.

Grazing of waterways may be possible, but grazing should be strictly controlled. Enough plant growth must be left to maintain a healthy, vigorous sod. Never permit overgrazing, and do not graze when the soil is too wet, during initial establishment, or during reseeding of problem areas.

A waterway also can be managed for optimum wildlife habitat by selecting specific grass species and mowing practices. Mowing should be done at a time that does not interfere with the nesting, hatching, or rearing of wildlife. Contact your local Natural Resources Conservation Service or Kansas Wildlife and Parks Department office for additional information.

A Complete Soil and Water Conservation Program

The choice of field management practices can significantly impact terrace and waterway systems. No-till cropping systems and reduced till systems that maintain high levels of residue will reduce sediment movement on agricultural fields. Maintaining high levels of surface residue also reduces runoff water and thus the total amount of sediment entering the waterway. Rainfall rates during intense thunderstorms often exceed the soil intake rate, which leads to runoff. Runoff water must then be transported from the fields in a safe manner that does not create gullies. Erosion is particularly hazardous on tilled soils with little protective residue. Waterways are designed to safely discharge excess water that flows from fields. Waterways and terraces used with contour planting and proper residue management are key components to a complete soil conservation plan. K-State Research and Extension, the Natural Resources Conservation Service, and other organizations are dedicated to helping farmers, ranchers, and landowners reduce soil erosion caused by wind and water.

Summary

Do

- Inspect waterways once a year and after every heavy rainstorm.
- Remove grass by mowing, haying, or grazing. If mowing with a sickle mower, remove clippings; if mowing frequently or if using a rotary mower, the clippings are chopped up and need not be removed.
- Fertilize according to soil test recommendations and forage or seed needs.
- Lift tillage equipment and shut off sprayers when crossing waterways.
- Remove sediment and fill eroded spots and wheel ruts quickly.
- Control erosion and runoff in fields draining into the waterway to reduce sedimentation and possible herbicide damage.

Do not

- Mow shorter than 3 to 4 inches
- Use the waterway as a road or cattle path. Tire tracks or cattle trails are often the beginning of gully erosion.
- Let the grass get clumpy. Water will cut channels between clumps rather than flow through the grass. This will cause erosion.
- Overgraze the waterway. Bare spots are subject to wash-out, and grass that is too short does not provide adequate erosion protection.

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