Stormwater Best Management Practice

Soil Roughening

Minimum Measure: Construction Site Stormwater Runoff Control
Subcategory: Erosion Control

Description

Soil roughening is a temporary erosion control practice that often occurs in conjunction with grading. Soil roughening involves increasing the relief of a bare soil surface with horizontal grooves by either stair-stepping (running parallel to the contour of the land) or using construction equipment to track the surface. Slopes without fine-grading that remain in a roughened condition can also reduce erosion. Soil roughening reduces stormwater velocity, increases infiltration, reduces erosion, traps sediment, and prepares the soil for seeding and planting by giving seed an opportunity to take hold and grow. A rough soil surface allows surface ponding that protects lime, fertilizer and seed and decreases erosion potential. Grooves in the soil are cooler and provide more favorable moisture conditions than hard, smooth surfaces. These conditions promote seed germination and vegetative growth.

Applicability

Soil roughening is appropriate for all slopes but works especially well on slopes greater than 3:1, on piles of excavated soil and in areas with highly erodible soils (MDOT, 2015; Lake, 2016). This technique is a good option for soils that construction staff frequently disturb because roughening is relatively easy. To slow erosion, construction staff should roughen the soil as soon as possible after removing the vegetation from the slope or immediately after ceasing grading activities (temporarily or permanently). Use the practice in conjunction with seeding, mulching and chemical stabilization to stabilize an area. A combination of surface roughening and vegetation is appropriate for steeper slopes and slopes that will remain bare for longer periods of time.

Siting and Design Considerations

Certain soils are difficult to apply soil roughening to as they can compact easily. Construction staff should avoid excessive soil compaction as it inhibits vegetation growth and causes higher stormwater velocity. If using tracked machinery, staff should limit roughening to sandy soils that do not compact easily. Clay soils compact extremely easily, especially when wet. If clay soils or soils with high clay content require soil roughening, operators should consider lighter tools such as walk-behind tillers. Construction staff should seed roughened areas as quickly as possible to minimize the exposure of bare earth to rain. Dust control procedures can help reduce erosion while the site establishes vegetation.

Soil roughened with tracked machinery can provide temporary erosion control.

Photo Credit: Anthony D'Angelo for USEPA, 2012

Soil roughening methods depend on slope and project conditions. Methods include stair-step grading, grooving and tracking. When choosing a method, consider factors such as slope steepness, mowing requirements, whether the slope is formed by cutting or filling, and available equipment. Smolen et al. (2013) outlines soil roughening methods, which can include:

- ***Cut slope roughening for areas that construction staff will not mow*** – Stair-step grades or groove-cut slopes are suitable for gradients steeper than 3:1 or any erodible material that is soft enough for a bulldozer to rip. Stair-step grading is also suitable for slopes consisting of soft rock with some subsoil. The

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vertical cut distance should be less than the horizontal distance, with the slope of the horizontal portion of the step angling slightly down toward the vertical wall to slow stormwater and promote ponding and infiltration. Individual vertical cuts should be less than 2 feet deep in soft materials and less than 3 feet deep in rocky materials.

- ***Grooving*** – This technique uses machinery to create a series of ridges and depressions that run across the slope along the contour. Construction staff can make grooves using any appropriate implement that they can safely operate on the slope, such as disks, tillers, spring harrows or the teeth on a front-end loader bucket. Grooves should have a maximum depth of 3 inches and be less than 15 inches apart.
- ***Fill slope roughening for areas that construction staff will not mow*** – Staff should place fill slopes with a gradient steeper than 3:1 in lifts less than 9 inches. They should compact each individual lift according to design specifications. The face of the slope should consist of loose, uncompacted fill 4 to 6 inches deep. If necessary, construction staff can roughen slope faces by grooving the surface using the above techniques. They should not smooth, scrape or compact slope faces because it would limit the ability of the site to establish vegetation.
- ***Cuts, fills and graded areas that staff will mow*** – Mowed slopes should be no steeper than 3:1. Construction staff can roughen mowed slopes with shallow grooves less than 10 inches apart and deeper than 1 inch using normal tilling, disking or harrowing equipment (they can also use a cultipacker-seeder). Excessive roughness is undesirable where staff plan to mow.
- ***Roughening with tracked machinery*** – To avoid undue compaction of the soil surface, construction staff should only conduct roughening with tracked machinery in sandy soils. If staff implement roughening with tracked machinery, they should make track routes perpendicular to the slope so that the grooves of the tracks align with the contour. Tracking is generally not as effective as other roughening methods.

Limitations

Soil roughening is not appropriate for rocky slopes. Tracked machinery can excessively compact the soil. Typically, roughened surfaces only withstand gentle or shallow depth rains. If a heavy storm washes away roughening, construction staff typically have to re-roughen and reseed surfaces.

Maintenance Considerations

Construction staff should inspect roughened areas after storms to see if re-roughening is necessary. Regular inspection should indicate where additional erosion and sediment control practices are necessary. Staff should immediately fill, regrade and reseed any rills (small watercourses that have steep sides and are usually only a few inches deep) that appear.

Effectiveness

Soil roughening provides moderate erosion protection for bare soils while the site establishes vegetative cover. It is an inexpensive and simple temporary erosion control, and it is effective in use with other erosion and sediment control practices.

Cost Considerations

Soil roughening requires minimal materials but requires using equipment that varies in price. Rental costs of smaller pieces of equipment, such as hand tillers or disk harrows, are generally $50 to $100 per day (RSMeans, 2020). Larger sites generally require larger, more expensive equipment. However, heavy equipment, like a bulldozer, is often already present on construction sites, and rented attachments such as rippers or scarifiers can accomplish soil roughening. The cost of such attachments also tends to be in the range of $50 to $100 per day (RSMeans, 2020). In all cases, also consider the cost of labor, which varies according to the size of the area construction staff are roughening.

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

Lake, D. W. (2016*). New York State standards and specifications for erosion and sediment control*. New York State Department of Environmental Conservation.

Montana Department of Transportation (MDOT). (2015). *Erosion and sediment control best management practices manual*.

RSMeans. (2020). Grading data from Gordian [Online data file]. RSMeans data from Gordian.

Smolen, M. D., Miller, D. W., Wyatt, L. C., Lichthardt, J., & Lanier, A. L. (2013). *Erosion and sediment control planning and design manual*. North Carolina Sedimentation Control Commission; North Carolina Department of Environment, Health, and Natural Resources; and Division of Land Resources, Land Quality Section.

Disclaimer

This fact sheet is intended to be used for informational purposes only. These examples and references are not intended to be comprehensive and do not preclude the use of other technically sound practices. State or local requirements may apply.