Water Resources Division

Grading Management

Definition

Grading is the temporary or permanent reshaping of the ground surface to planned elevations determined by engineering survey evaluation and layout. Grading is also sometimes referred to as earthmoving, or earth change activity. The purpose of this best management practice (BMP) is to show how to conduct grading activities while minimizing soil erosion and controlling storm water runoff, in a manner that reduces the risk of damage to natural resources, adjoining properties, or human health. This BMP covers both basic grading management concepts and specific types of grading-related practices that can be used to reduce erosion.

Pollutants Controlled

The objective of properly managing grading activity is to keep sediment on-site, minimize sediment suspended in runoff, stabilize slopes, and decrease runoff velocity. A pilot study (Caltrans, 2000) of test plots compared the soil erosion and runoff rates of a smooth slope of bare soil, with four slopes that were roughened through various methods. The study showed measured reductions in erosion rates of 12 percent, 52 percent, 55 percent, and 76 percent, depending on the method used. At the same time, the study also noted decreased runoff rates of 4 percent and 19 percent for two of the methods, and increased runoff rates of 2 percent and 12 percent for the other two methods. The increases were believed to be caused by soil compaction.

Location

Apply these practices wherever earth moving or other land changes occur, or where construction activities result in grades which may increase erosive velocities or off-site sedimentation.

Companion & Alternate Practices

Consider using Diversions to prevent run-on from causing erosion on exposed soil and runoff from entering waters of the state. To prevent off-site sedimentation, control measures such as Silt Fencing, Grade Stabilization Structures, or Sediment Basins may be needed around the perimeter of construction sites, especially on the downslope side. Stage and Schedule all projects to minimize the area of a site being exposed at any one time. Surface roughening (which is also referred to as scarification) is a grading practice that can be used to reduce erosion from a construction site. This practice is described below.

Grading activity has the potential to trigger the need for a number of Michigan Department of Environmental Quality (MDEQ) permits. Please see the Permit Information Checklist for information about which permits may be applicable to your particular grading activity, and who to contact to determine how to obtain a permit.

Specifications

Planning Prior to Commencement of Grading

1. Make decisions regarding the steepness of cut and fill slopes and how the slopes will be protected from runoff, stabilized, and maintained.

2. Plan all grading to complement the natural contours of the landscape.

3. Minimize the depth of grading to prevent exposing extensive amounts of subsoil. Stockpile and re-spread any topsoil removed from a graded area.

4. Develop a grading plan to establish drainage areas, direct drainage patterns, and decrease runoff velocities. Coordinate the grading plan with the soil erosion and sedimentation control (SESC) and storm water plans.

5. Set the slopes of any areas which in the future will be mowed at or below 3H:1V.

6. Determine when grading will begin and when it will cease. Land grading should be a key consideration of construction staging and scheduling with the goal of exposing the smallest amount of soil for the shortest time period possible. Plan grading so that it's performed in stages according to the implementation schedule. Refer to the Staging and Scheduling BMP.

7. Determine where spoil piles will be placed and protect spoil piles following specifications in the Spoil Piles BMP.

8. To ensure even settling, ensure that any fill to be used is free of objectionable material, such as logs, rocks, or stumps. Do not use frozen or mucky material for fill.

9. Do not place fill adjacent to channel banks, which could possibly cause bank failure or result in downstream sediment deposition.

10. Evaluate the proposed final grading plan to ensure that changes to storm water runoff will not cause unnatural discharge to or otherwise negatively affect any neighboring properties.

During Grading

1. Prior to beginning grading, install and/or construct all erosion and sedimentation control practices.

2. Remove vegetative matter in accordance with Land Clearing specifications. If topsoil must be removed, store it in temporary Spoil Piles until final grading. To prevent erosion, place temporary Spoil Piles away from wetlands, streams, or lakes. If such placement is not feasible, ensure that Spoil Piles located near any of these water bodies are temporarily seeded and protected with a perimeter SESC practice, such as Silt Fence.

3. Do not grade to the edge of watercourses. If a natural, vegetated, appropriately-sized Riparian Buffer maintained at a width and condition identified in the BMP cannot be left in place and/or upon direction by the SESC plan or by the SESC permitting agency, construct a berm or place Silt Fence adjacent to the watercourse or wetland.

4. Divert runoff to stabilized areas, according to the grading plan, and/or SESC plan.

5. Finish grade and compact according to the intended use of the area. Refer to the appropriate BMP for additional information on the finish grading procedures and the degree of compaction needed.

6. To retain water, increase infiltration, and facilitate vegetative growth on slopes, use one of the techniques described below:

    a. Surface Roughening/Scarification: Use this method in any areas which can safely accommodate disks, tillers, spring harrows, or the teeth of a front-end loader bucket. In areas which will not be mowed, use equipment to create grooves perpendicular to the slope. Grooves should not be less than 3 inches deep, nor more than 15 inches apart. In cuts, fills, and areas that will be mowed, grooves should be less than 10 inches apart and not less than 1 inch deep. Irregularities in the soil surface catch rainwater, and retain seed and nutrients when applied. Refer to Figure 1 for an example of ground that has been grooved. Another method is to run tracked machinery (such as a bulldozer) up and down slopes to leave depressions in the soil perpendicular to the direction of flow. To avoid undue soil compaction, use this method only on sandy soils. Do not back-blade during final grading. Refer to Figure 2 for an example of a bulldozer tracking a slope;

    b. Stair-Step Grading: Use this method on slopes steeper than 3H:1V which have material soft enough to be bulldozed and which will not be mowed in the future. Make the vertical cut less than the horizontal distance, and do not exceed two (2) feet in soft material and three (3) feet in rocky material. Grade the stair steps so that the 'treads' (i.e., the parts of stairs typically horizontal) are actually tiled back slightly, so any runoff on the 'tread' actually flows into the 'riser' (i.e., the part of stairs typically vertical).

7. Use proper Tree Protection techniques to maintain the health and integrity of the trees. Excavate as far away from the drip line as possible.

8. When raising the grade around trees:

    a. Protect the trees by constructing tree wells around the trees, at or outside the drip line, to protect the natural soil in the area of the feeder roots, and to protect the trunk and branches from potential damage through direct contact. Refer to the Tree Protection BMP.

    b. Design the tree well to allow drainage within the well and around the root system inside the drip line.

9. When lowering the grade around trees:

    a. Protect the trees by constructing tree walls made of large stones, brick, building tile, or concrete or cinder block. To protect tree roots, locate the walls at or outside of the drip line. Refer to the Tree Protection BMP.

    b. Include adequate drainage through the wall.

After Construction

1. As soon as grading is completed, in a timeframe not to exceed five (5) days, or when work is interrupted for fourteen (14) or more working days, stabilize all disturbed areas by initiating the establishment of vegetation with Seeding and Mulching, or by placing crushed stone, riprap, or other ground cover, or by installing Slope/Shoreline Stabilization structures;

2. Stabilize slopes in excess of 2H:1V using the specifications in the Critical Area Stabilization BMP;

3. Mulching can be used to temporarily stabilize areas where final grading is being delayed.

4. Maintain whatever temporary SESC measures are needed until final, permanent stabilization is achieved.

Maintenance

Desired grades must be maintained until the proposed land use is established with a structure, pavement, or vegetation. In addition, any BMPs installed in association with the grading must be maintained until the graded area is permanently stabilized.

Literature Cited

California Department of Transportation (Caltrans). 2000. *District 7 Erosion Control Pilot Study*. Caltrans Document No. CTSW-RT-00-012.

Michigan Department of Natural Resources (MDNR). 1975. *Michigan Soil Erosion & Sedimentation Control Guidebook*. Division of Land Resource Programs. Page 24.

Virginia Department of Environmental Quality (VDEQ). 1992. *Virginia Erosion and Sediment Control Handbook*. Third Edition.

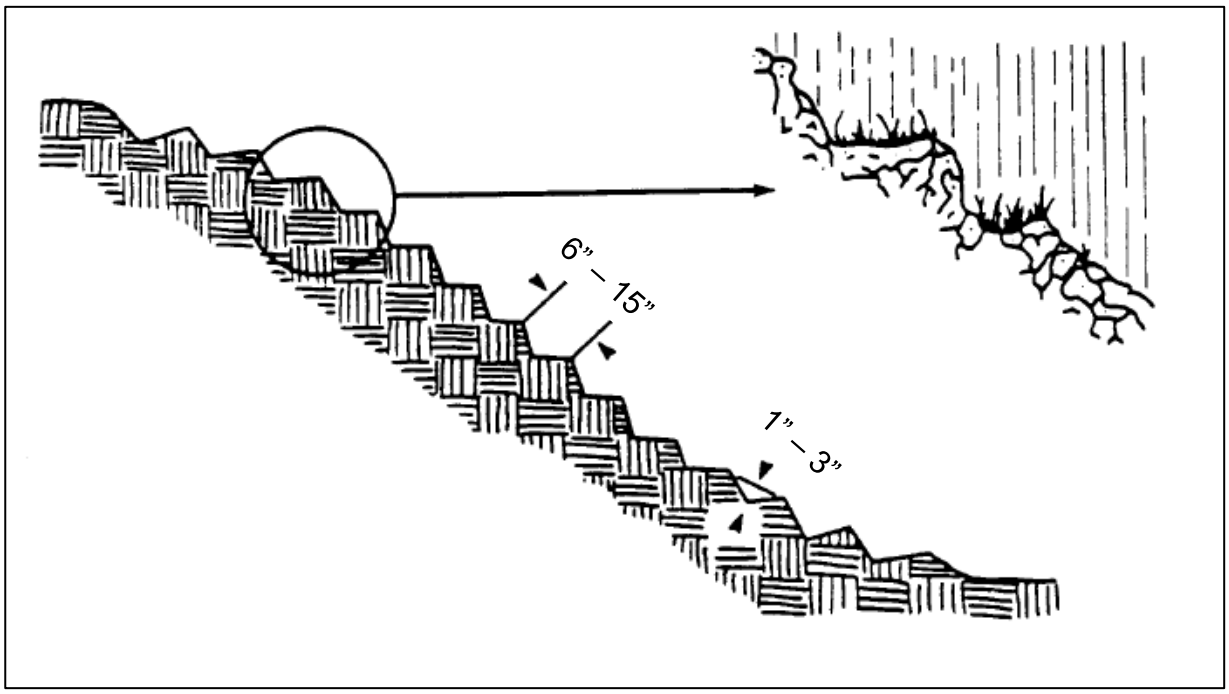

Figure 1. Side View of a Grooved Slope, Shown Catching Rainwater, Seed, and Nutrients

Source: VDEQ, 1992.

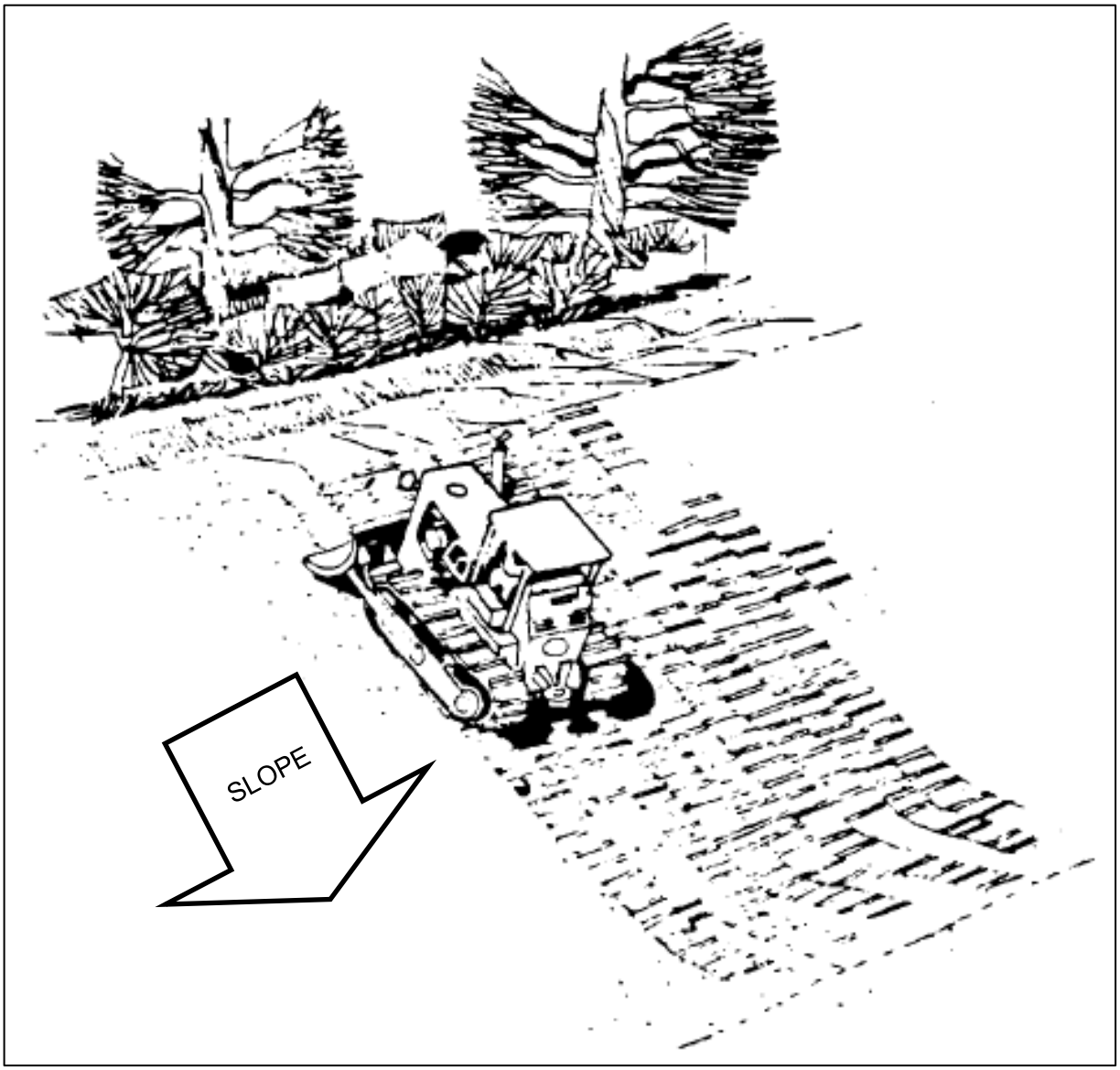

Figure 2. Bulldozer Tracking Soil Perpendicular to Ground Slope

Source: MDNR, 1975