

## **STANDARD FOR LAND GRADING**

### Definition

Reshaping the ground surface by grading to planned elevations which are determined by topographic survey and layout.

### Purpose

The practice is for one or more of the following: Provide more suitable sites for land development; improve surface drainage and control erosion.

### Conditions Where Practice Applies

This practice is applicable where grading to planned elevations is practical and it is determined that grading is needed. Grading that involves the disturbance of vegetation over large areas shall be avoided. It may be necessary to provide for temporary stabilization of large areas.

### Water Quality Enhancement

Proper grading of disturbed sites will protect against soil loss from erosion, enhance establishment of permanent vegetative cover and help to properly manage stormwater runoff all of which will reduce off site discharge of pollutants.

### Planning Criteria

The grading plan and installation shall be based upon adequate topographic surveys and investigations. The plan is to show the location, slope, cut, fill and finish elevation of the surfaces to be graded. The plan should also include auxiliary practices for safe disposal of runoff water, slope stabilization, erosion control, minimization of compaction and drainage. Facilities such as waterways, ditches, diversions, grade stabilization structures, retaining walls and subsurface drains should be included where necessary.

Erosion control measures shall be designed and installed in accordance with the applicable standard contained herein.

The development and establishment of the plan shall include the following:

1. Topsoil is to be stripped and stockpiled in amounts necessary to complete finish grading of all exposed areas requiring topsoil. See the Standard for Topsoiling for quality criteria and proper handling.
2. The cut face of earth excavations and fills shall be no steeper than the safe angle of repose for the materials encountered and flat enough for proper maintenance.
3. The permanently exposed faces of earth cuts and fills shall be vegetated or otherwise protected from erosion.
4. Provisions shall be made to safely conduct surface water to storm drains or suitable water courses and to prevent surface runoff from damaging cut faces and fill slopes.
5. Subsurface drainage is to be provided in areas having a high water table, to intercept seepage that would adversely affect slope stability, building foundations or create undesirable wetness. See Standard for Subsurface Drainage.

6. Adjoining property shall be protected from excavation and filling operations.
7. Fill shall not be placed adjacent to the bank of a stream or channel, unless provisions are made to protect the hydraulic, biological, aesthetic and other environmental functions of the stream.
8. Use of low ground pressure equipment will be preferred where ever possible to minimize compaction.
9. Construction traffic will be planned and controlled to restrict or limit travel to only those areas absolutely necessary to permit safe operation of equipment and permit proper construction of site facilities. Travel lanes, parking and material storage shall be clearly marked and flagged to limit unnecessary compaction of subsoils.
10. To the greatest extent possible, avoid travel over excessively wet (field capacity) soils to avoid compaction.

### Soil Management and Preparation

The remainder of this Standard addresses the potential for soil compaction by establishing three categories of treatment based on compaction potential and land use: soil stabilization areas, soil restoration areas and deep infiltration areas.

#### **1. Soil Stabilization Areas**

Due to use or setting, certain disturbed areas will not require compaction remediation including the following:

- a. Within 10 feet of building foundations
- b. Where soils will be required to support vehicle traffic loads such as roads, parking lots and driveways (including gravel surfaces) or pedestrian walkways (sidewalks etc)
- c. Areas requiring industry or government specified soil designs such as but not limited to: golf courses, landfills, wetland restoration, septic disposal fields, etc.
- d. Slopes determined to be inappropriate for safe operation of equipment
- e. Other general areas where increased infiltration through surface soils is not desirable (i.e, over septic fields)
- f. Areas where no heavy equipment travel or other disturbance has taken place (no compaction)
- g. Areas receiving temporary vegetative stabilization in accordance with that Standard.

#### **2. Soil Restoration Areas**

Areas designated for soil restoration are to be stabilized against erosion and receive the additional treatments described below to remediate excessive compaction. Subgrade soils prior to the application of topsoil shall be free from excessive compaction to a depth of 6.0” to facilitate drainage and enhance the establishment of permanent vegetative cover.

The contractor may elect to test the subgrade for excessive compaction in lieu of implementing restoration measures outlined below. Testing for compaction shall be performed as follows:

- a. 1.0 acre or less – survey flag wire (no smaller than 16 gage) penetration tests at 4 evenly distributed locations. Wire should penetrate the subsoil to a depth of 6.0 inches without bending. Soil should be reasonably moist, but not saturated. Excessively dry soils may give a ‘false’ reading of being compacted.
- b. Greater than 1.0 acre - bulk density shall be measured at 4 evenly distributed locations per acre in

accordance with testing methods specified below and compared to table 19-1. The subsoil bulk density must be at or below those listed in the table for the specific soil type:

Table 19-1 - Maximum Bulk Densities (gm/cc) by soil type <sup>1</sup>

Soil type	Target Bulk Density
Sands	1.6
Very fine sand	1.6
Sandy Loam	1.6
Sandy Clay Loam	1.6
Silt Loam	1.5
Clay	1.4

Testing procedures shall be as prescribed by “Methods of Soil Analysis”<sup>2</sup> or applicable ASTM Standards. If bulk density values are equal to or below those shown in table 19-1, no further remediation efforts are required.

### Procedures for Compaction Remediation

If subgrade soils are determined to be compacted by simple survey wire or bulk density testing, the following procedures shall be followed to reduce the effects of excessive soil compaction prior to establishment of permanent vegetative cover.

- Bring site to rough grade elevation (finish grade must accommodate a depth of 6.0” of topsoil placement).
- Spread topsoil uniformly. Topsoil shall conform to all quality criteria in accordance with the Standard for Topsoil including organic matter content.
- Rip the subsoil (with 6” lift of topsoil in place) to a depth of 6” (total depth of 12”) in one direction. Do not re-travel over ripped soils. Chisel plow-type implements shall not overturn or mix the sub and topsoil. The objective is to lift both layers in place and fracture the subsoil to a depth of 6.0”.
- After ripping, finish grade topsoil to remove irregularities, ruts etc. Use of low ground pressure equipment or hand raking is preferred where practicable and feasible. Care must be taken to avoid re-compacting ripped soils.
- Apply permanent vegetative cover measures in accordance with applicable Standards (Permanent Vegetative Cover, Permanent Stabilization with Sod)

### 3. Deep Infiltration Areas

Areas designated for “deep infiltration” including infiltration basins, rain gardens and other locations planned for groundwater recharge are to be stabilized against surface erosion as noted in section 1(c), “Soil stabilization areas”. Specific designs intended to induce deep percolation to provide groundwater recharge may be found in the following resources:

- NJDEP Best Management Practices Manual, Revised 2009, chapter 9.5 for Infiltration Basins
- Rutgers University Water Resources Program (<http://water.rutgers.edu/>)

<sup>1</sup> USDA NRCS Soil Quality – Urban Technical Note No. 2, Table 2, March 2000

<sup>2</sup> Methods of Soil Analysis-Part 4. Physical Methods. By J.H. Dane and G.C. Topp, ed. 2002

- c. Other authoritative sources for amending soil for the primary purpose of enhancing deep infiltration and recharge.

**General Installation Requirements**

In all cases, site grading shall conform to the following general quality criteria:

- a. Timber, logs, brush, rubbish, rocks, stumps and vegetative matter which will interfere with the grading operation or affect the planned stability or fill areas shall be removed and disposed of according to the plan.
- b. Fill material is to be free of brush, rubbish, timber, logs, vegetative matter and stumps in amounts that will be detrimental to constructing stable fills.
- c. All structural fills shall be compacted as determined by structural engineering requirements for their intended purpose and as required to reduce slipping, erosion or excessive saturation. This shall not preclude the need to alleviate compaction at the top 12 inches of soil as required above.
- d. All disturbed areas shall be left with a neat and finished appearance and shall be protected from erosion. See Standards for Permanent Vegetative Cover for Soil Stabilization.
- e. Trees to be retained shall be protected if necessary in accordance with the Standard for Tree Protection During Construction.