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DIVISION 02 - SITE CONSTRUCTION

SECTION 02315

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06/04

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SECTION 02315

EXCAVATION AND FILL
06/04

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

All work in this broadscope section relates to clearing and grubbing, excavation grading, and fill and backfill required for site preparation or earthwork.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180 (2001) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASTM INTERNATIONAL (ASTM)

ASTM C 117 (2003) Standard Test Method for Materials Finer than 75-micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 136 (2001) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM D 1556 (2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

- ASTM D 1557 (2002e1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³)
- ASTM D 2216 (1998) Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D 2922 (2001) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- ASTM D 3282 (1993; R 1997e1) Standard Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1926 (2001) Safety and Health Regulations for Construction

1.2 DEFINITIONS

Satisfactory materials shall mean ASTM D 3282, Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

Unsatisfactory soil materials shall mean ASTM D 3282, Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soil, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

Subgrade shall mean the top surface of a backfill or fill or the uppermost surface of an excavation, graded to conform to the required subgrade elevation and compacted to support a structure.

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in AASHTO T 180, Methods B or D.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Construction Equipment List shall be submitted.

Records of Underground Utilities shall be submitted for the following items:

- Location of Inspections
- Location of Testing
- Location of Utility Approvals

SD-06 Test Reports

Contractor shall submit written Test Reports of Soil Test results within 5 calendar days. Submit test reports in accordance with paragraph entitled, "Quality Control Testing During Construction," of this section.

SD-07 Certificates

Certificates of Compliance for Compost shall be submitted indicating grade and compliance to state and local regulations.

1.4 QUALITY CONTROL TESTING DURING CONSTRUCTION

Soil materials shall be tested by the Contractor during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Soil materials specified	Sieve analysis of fine and coarse aggregates	ASTM C 136	One daily for each soil material from each source; additional test whenever there is any apparent change
	Amount of material passing No. 200 75 micrometer sieve	ASTM C 117	
	Moisture content of subbase material	ASTM D 2216	
Soil materials prior to compaction	Moisture-density relations of soil	ASTM D 1557	One of each type of sub-grade soil material except under backfill for structures; one for each backfill and fill material from each source

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556 Sand Cone Method or ASTM D 2922 Nuclear Method	At least three daily for each subgrade soil material except under backfill for structures, and for each layer and backfill and fill material; additional test whenever there is any change in moisture conditions

1.5 TEST REPORTS

No soil material shall be used until a written report of Soil Test results has been reviewed and approved by the Contracting Officer.

1.6 CONSTRUCTION EQUIPMENT LIST

Construction Equipment List for all major equipment to be used in this section shall be submitted to the Contracting Officer prior to start of work.

1.7 UNDERGROUND UTILITIES

Records of Underground Utilities Location of Inspections, Location of Testing and Location of Utility Approvals shall be submitted to the Contracting Officer prior to start of work.

PART 2 PRODUCTS

2.1 SUBBASE MATERIAL

Subbase material shall be a naturally or artificially graded mixture of natural or crushed gravel, crushed stone, or sand.

2.2 BACKFILL AND FILL MATERIALS

Materials for backfill and fill shall be satisfactory soil materials, free of clay clods, rock or gravel larger than 2 inches 50 millimeter in any dimension, debris, waste, frozen materials, and other deleterious matter.

2.3 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam. The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable material larger than 2 inches 50 millimeter in any dimension.

2.4 COMPOST

NOTE: Insert grade or class of compost suitable for the surface required. Insert local or state regulation defining class or grade of compost. Where local or state regulations do not define grade or class, insert requirements for screening to limit particle size.

Compost shall be yard trimmings or yard waste compost processed and graded according to state and local regulations. Compost shall be grade [_____] as defined by [_____] .

2.5 TOPSOIL BLEND

Where insufficient topsoil is removed from the project site, the topsoil removed shall be stockpiled and blended with compost at the site to achieve the required volume.

2.6 COMPACTION EQUIPMENT

Compaction equipment shall consist of sheepsfoot rollers, pneumatic-tired rollers, tamper rollers, vibrating tampers, or other compaction equipment capable of obtaining the required density throughout the entire layer.

PART 3 EXECUTION

3.1 GENERAL

Before earthwork is started, the location of Underground Utilities shall be verified by hand methods. Utilities to be left in place shall be protected from damage.

Excavations shall be done in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

3.2 SURFACE PREPARATION

Heavy growths of grass and other vegetation, roots, debris, stones, objects larger than 2 inches 50 millimeter in any dimension, and other materials undesirable to the subsurface construction shall be removed by mowing, grubbing, raking, or other methods from the surface of areas to be stripped.

3.2.1 Stripping

Topsoil shall be stripped from the surface of those areas to receive fills or embankments.

Excavated topsoil shall be transported to, and stockpiled in, designated topsoil storage areas.

3.2.2 Clearing Operations

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish

occurring within the areas to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be completely removed except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches 40 millimeter or more in diameter and of live branches to the indicated height. Live limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts made shall be painted with tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.2.3 Grubbing Operations

Contractor shall completely remove stumps, roots, and organic or other debris protruding through the ground surface. This material shall be excavated and removed to a depth of not less than 8 inches 200 millimeter below the surface level of the original ground. Mechanical grubbing equipment shall not be used inside the drip lines of trees indicated to remain standing.

3.2.4 Filling Depressions

Depressions resulting from grubbing operations shall be completely filled with acceptable backfilling material, unless further excavation or earthwork is required.

Prior to filling, subgrade surfaces of depressions shall be free of standing water, frost, or frozen material. Unsatisfactory soil materials shall be removed.

Contractor shall place fill material in horizontal layers not to exceed 6 inches 150 millimeter in loose depth. Each layer shall be compacted at the optimum moisture content to a density equal to the original adjacent ground. Surface of filled depressions shall be graded to meet adjacent contours and to provide surface water drainage.

3.3 EXCAVATION

3.3.1 Stability of Sides

Sides of excavations over 5 feet 1500 millimeter in depth shall be sloped not steeper than 34 degrees from the horizontal (slope 1/1.5) of the material excavated or shall be shored and braced where sloping is not possible because of space restrictions, stability of material excavated, or where excavations are subjected to vibrations from vehicular traffic, the operation of machinery, or any other source.

Sides and slopes of excavations shall be maintained in a safe condition by scaling, benching, shelving, or bracing until completion of backfill placement.

3.3.2 Shoring and Bracing

Contractor shall adhere to and enforce precautions as outlined in OSHA Regulations, 29 CFR 1926, Subpart P.

3.3.3 Water Removal

Water shall not be permitted to accumulate in excavations. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions shall be provided by the Contractor and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.3.4 Excavation For Structures

Excavation for structures shall conform to the dimensions and elevations indicated in the Construction Documents within a tolerance of plus or minus 0.10 foot 30 millimeter and shall extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall be done just before concrete is placed. Bottoms shall be trimmed to the required lines and grades to leave a solid bed to receive concrete.

3.3.5 Excavation of Ditches, Gutters, and Channels

Excavation shall be accomplished by cutting accurately to the cross sections, grades, and elevations indicated. Excessive open-ditch or gutter excavation shall be backfilled with suitable materials to grade at no additional cost.

3.3.6 Excavation for Drainage Structures

Excavation shall be made accurately to the lines, grades, and elevations indicated. Dimensions and elevations of footings and foundation excavations are only approximate and may be changed if necessary to ensure adequate foundation support. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as indicated. Rock or other hard foundation materials shall be cleaned of loose debris and cut to a firm surface, either level, stepped, or serrated, as indicated. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before concrete or masonry is to be placed.

3.3.7 Trench Excavation

Trenches shall be of adequate width and depth for the specified purpose.

Side slopes of the trenches shall be as nearly vertical as practicable. Bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length except where it is necessary to excavate for bell holes and for proper sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded to ensure that the pipe rests on the prepared bottom for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint. Stones shall be removed, as necessary, to avoid point bearing. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6 inches 150 millimeter below the trench depth specified. Except as specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of trenches.

3.3.8 Removal of Unsatisfactory Soil Materials

Unsatisfactory soil materials encountered that extend below the required elevations shall be excavated to the depth directed by the Contracting Officer.

3.4 FILLING AND BACKFILLING

3.4.1 Preparations Prior to Backfill Placement

Excavations shall be backfilled as promptly as the work permits but not until completion of the following:

- Approval of construction below finish grade

- Inspection, testing, approval, and recording location of underground utilities

- Removal of concrete formwork

- Removal of shoring and bracing; backfilling of voids with satisfactory soil material; temporary sheet piling driven below bottom of structures; and cutting off and removing of utilities in a manner that prevents settlement of the structure or utilities

- Removal of trash and debris

- Completion of concrete waterproofing

3.4.2 Preparation of Ground Surface to Receive Fill

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the placement of fill. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stripped, or broken up in such manner that fill material will bond with the existing material.

When the ground surface has a density less than that specified for the particular area classification, the ground surface shall be broken up, pulverized, moisture-conditioned to near optimum moisture content of the soil material, and compacted to the required depth and percentage of maximum density.

3.4.3 Placement and Compaction

Backfill and fill materials shall be placed in layers not more than 6 inches 150 millimeter in loose depth. Before compaction, each layer of backfill or fill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material and shall then be compacted to the percentage of maximum density for each area classification. Backfill or fill material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Backfill and fill materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated elevations.

Compaction adjacent to structures, within a horizontal distance from the face of the structure equal to the depth of backfill or fill material (measured from the bottom of footing or bottom of foundation or retaining wall) to final grade, shall be done with power-driven hand tampers.

3.5 COMPACTION

3.5.1 Percentage of Maximum Density Requirements

Actual density of each layer of soil material-in-place shall be not less than the following percentages of the maximum density of the same soil material determined by the moisture-density test.

<u>AREA CLASSIFICATION</u>	<u>PERCENT MAXIMUM DENSITY</u>
Grassed areas	[90] [____]
Walks	[100] [____]
Structures	[100] [____]
Building slabs and steps	[100] [____]
Utility trenches	[90] [____]

3.5.2 Moisture Control

Moisture content in soil material at time of compaction shall be within specified limits.

Where the moisture content of a layer of soil material is below optimum before compaction, the required amount of water shall be uniformly applied to the surface of the layer of soil material and the layer of soil disked or otherwise mixed until a uniform moisture content is reached.

Where the moisture of a layer of soil material is above optimum, it shall be dried.

3.6 GRADING

3.6.1 General

Areas within the limits of grading under this section, including adjacent transition areas, shall be uniformly graded. Finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels

or slopes between points where elevations are indicated or between such points and existing grades.

3.6.2 Grading Outside Building Lines

Areas outside the building lines for each structure shall be graded to drain away from the structure and to prevent ponding of water after rains. Finished surface shall be within the tolerance specified below for each area classification, compacted as specified, and free from irregular surface changes.

3.6.2.1 Grassed or Planted Areas

Finished surface of areas to receive topsoil blend shall be not more than 0.10 foot 30 millimeter above or below the indicated subgrade elevations.

3.6.2.2 Walks

Surface of areas under walks shall be shaped to line, grade, and cross section; finished surface shall be not more than 0.0 foot 0.0 millimeter above or 0.10 foot 30 millimeter below the indicated subgrade elevation.

3.7 MAINTENANCE

3.7.1 Protection of Graded Areas

Newly graded areas shall be protected from traffic and erosion and shall be maintained free of trash or debris.

3.7.2 Reconditioning Compacted Areas

Where approved compacted areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified, reshaped, and compacted as specified to the required density prior to further construction.

-- End of Section --