

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for walks, pavements and lawns and grasses.
 - 2. Excavating and backfilling for structures.
 - 3. Subbase course for concrete walks and pavement.
 - 4. Subbase and base course for paving.
 - 5. Excavating and backfilling for utility trenches.
 - 6. Excavating and backfilling trenches for buried utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
 - 2. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
 - 3. Divisions 26 and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil (Select Borrow) imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.

1. Authorized Additional Excavation: Excavation below subgrade elevations as directed by the Geotechnical Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 2. Bulk Excavation: Excavation more than **10 feet** in width and more than **30 feet** in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations without direction by the Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by the Geotechnical Engineer, shall be without additional compensation.
- G. Fill: Soil materials approved by the Geotechnical Engineer to be used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed **1 cu. yd.** for bulk excavation or **3/4 cu. yd.** for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a **42-inch-wide**, maximum, short-tip-radius rock bucket; rated at not less than **138-hp** flywheel power with bucket-curling force of not less than **28,090 lbf** and stick-crowd force of not less than **18,650 lbf**; measured according to SAE J-1179.
 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than **210-hp** flywheel power and developing a minimum of **48,510-lbf** breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- 1.4 SUBMITTALS
- A. Product Data: For the following:
1. Each type of detectable warning tape.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

- C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials, rock-definition testing, and verification of the presence of contaminate materials, as documented according to ASTM D 3740 and ASTM E 548.
- B. Contractor shall follow all OSHA requirements and all local, State and Federal regulations for soil excavation.
- C. Pre-excavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
 - 4. Verify existing utility services for area where Project is located before excavation.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Refer to Section 916 of SHA Standard Specifications for Construction and Materials.
- B. General: Provide select borrow soil materials for replacement of all excavated material removed from the pipe trench. All excavated material deemed unsuitable by the geotechnical engineer removed from the trench excavations shall be hauled and disposed off-site. Provide test results or certification that borrow material meets the requirements for the specified material.
- C. Satisfactory Soils: Select Borrow as Per Section 916.01.01 of the MSHA Standard Specifications for Construction and Materials.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a **1-1/2-inch** sieve and not more than 12 percent passing a **No. 200** sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials.

- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a **1-1/2-inch** sieve and not more than 8 percent passing a **No. 200** sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a **1-1/2-inch** sieve and not more than 12 percent passing a **No. 200** sieve.
- G. Bedding Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a **1-inch** sieve and 0 to 5 percent passing a **No. 4** sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a **1-1/2-inch** sieve and 0 to 5 percent passing a **No. 8** sieve.
- I. Topsoil: Loam, without stones or debris larger than 1/2 inch in diameter, without roots, vegetation, and without harmful materials or other debris which may be harmful to plant life. The topsoil shall contain a minimum of 5% - 8% of organic matter by weight when tested in accordance with AASHTO T 194. Other components shall be within the following percentages:
 - Silt 25 – 50%
 - Clay 10 – 30 %
 - Sand 20 – 35 %
 - pH 6 – 7.0
 - Soluble Salts 500 ppm maximum
- 1. Topsoil shall be the deeper of either a 4" depth or as recommended by the Soil Testing Laboratory.
- 2. Off-Site Topsoil: Topsoil furnished by the Contractor shall meet the requirements specified above, as tested by the Contractor and by an independent, state-operated, or university-operated laboratory recognized by the State Department of Agriculture, as noted in Specification 329200 / 329300 and approved by the Geotechnical Engineer.
- 3. All type and quantity of soil amendments required shall be per Soil Testing Laboratory's recommendations in weight per 1000 sq. ft. or volume per cu. yd.
- J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a **1-inch** sieve and 0 to 5 percent passing a **No. 4** sieve.
- K. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- M. Structural Fill: All fills placed directly below or within the zone of influence of any bearing foundation or structural slab. Structural fill material shall consist of soils meeting Unified Soil Classification System (USCS) of SM or greater (i.e. SM through GW). GC and SC materials may be utilized as compacted structural fill if they contain less than 35% passing No. 200 sieve and a maximum Plasticity Index of 15. All soil materials that fall within the USCS type OL, OH, CH, CL, MH, and ML, as well as material containing organic matter, ashes, cinders, refuse, frozen or other unsuitable materials are prohibited for use as Structural Fill. The soils classified as CL, ML; and CH/MH with a maximum Liquid Limit of 60% and Plasticity Index of 30%, can be

used as structural fills at depths greater than 4-feet below pavement subgrades and within non-structural areas.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, **6 inches** wide and **4 mils** thick, continuously inscribed with a description of the utility, with a metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches. Color shall be as follows.
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Prepare subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls in accordance with Maryland Department of the Environment and Baltimore City requirements during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives on this project.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. Excavated materials will be hauled and disposed off-site. Fill and backfill shall be satisfactory soil materials meeting paragraph 2.1.C.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. **6 inches** beneath bottom of concrete slabs on grade.
 - b. **6 inches** beneath pipe in trenches, and the greater of **24 inches** wider than pipe or **42 inches** wide.
- B. Contaminated Soils Excavation: Soils classified as being contaminated in accordance with the Environmental Investigation Report shall be utilized as fill material in accordance with the recommendations of the Environmental Investigation report. Excess contaminated material shall be hauled off and disposed of to a safe and legal facility authorized to receive the contaminated material. Removal, handling, and disposal of contaminated material shall be without additional compensation.
 - 1. Notify the Geotechnical Engineer when excavations commence to test for the presence of contaminants.
 - 2. Provide over excavation of material to be exposed to the surface in the finished condition to a depth in accordance with the Environmental Investigation Report. Backfill over excavation with suitable material to finished grade in accordance with the Environmental Inspection Report.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to the indicated elevations and dimensions within a tolerance of plus or minus **1 inch**. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Basins and Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus **1 inch**. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to **12 inches** higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints and barrels of pipes, unless otherwise indicated.
 - 1. For pipes less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe on an undisturbed subgrade.
 - 2. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

- A. Notify Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for Unit Price Items.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations by extending bottom elevation of concrete foundation to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of **2500 psi**, may be used when approved by the Engineer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials only at locations that have been approved by the Owner. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Surveying locations of underground utilities for Record Documents.
 - 2. Testing and inspecting underground utilities.
 - 3. Removing concrete formwork.
 - 4. Removing trash and debris.
 - 5. Removing temporary shoring and bracing, and sheeting.
 - 6. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under structure and within **18 inches** of bottom of structure with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- D. After installing compacted pipe bedding material, place and compact initial backfill of satisfactory soil, free of particles larger than **1 inch** in any dimension, to a height of **12 inches** over the utility pipe or conduit.
 - 1. Carefully compact initial bedding material under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Install warning tape directly above utilities, **12 inches** below finished grade, except **6 inches** below subgrade under pavements and slabs. Warning tape is not required for storm drains.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **8 inches** in loose depth for material compacted by heavy compaction equipment, and not more than **4 inches** in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under pavements, scarify and recompact top **12 inches** of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at 92 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus **1/2 inch**.
 2. Walks: Plus or minus **1/4 inch**.
 3. Pavements: Plus or minus **1/4 inch**.

3.17 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Place base course material over subbase course under hot-mix asphalt pavement.
 2. Shape subbase and base course to required crown elevations and cross-slope grades.
 3. Place subbase and base course **6 inches** or less in compacted thickness in a single layer.
 4. Place subbase and base course that exceeds **6 inches** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches** thick or less than **3 inches** thick.
 5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: The owner shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every **2000 sq. ft.** or less of paved area, but in no case fewer than 3 tests.
 2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each **150 feet** or less of trench length, but no fewer than 2 tests.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000