

SECTION 02317

TRENCHING FOR SITE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating trenches and backfill for utilities, including underslab utilities.
- B. Excavating for manholes, catch basins and other structures.
- C. Compacted bedding and compacted backfilling over utilities to subgrade elevations.
- D. Compacted base and compacted backfilling for manholes, catch basins and other structures to subgrade elevations.
- E. Compaction requirements.
- F. Dust control.

1.02 RELATED SECTIONS

- A. Section 02315 - Common Excavation, Embankment and Compaction.
- B. Section 02510 - Water Distribution.
- C. Section 02535 - Sanitary Sewer Piping.
- D. Section 02635 - Storm Drainage Piping.
- E. DIVISION 15 - MECHANICAL
- F. DIVISION 16 - ELECTRICAL

1.03 REFERENCES

- A. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2005.
- B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2000a.
- C. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2002.
- D. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
- E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2004.
- F. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2004.
- G. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2000.

1.04 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: As Indicated on drawings or the bottom of aggregate subbase gravel in paved areas, the bottom of aggregate base gravel in sidewalk areas, the bottom of loam in seeded areas, or to 1 foot below finished floor elevation.

1.05 SUBMITTALS

- A. Samples: 75 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- B. Materials Sources: Submit name and location of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Protect plants, lawns, and other features to remain.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- F. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.
- G. Protect above or below grade utilities which are to remain. Repair any damage caused by construction of this project at no cost to Owner.
- H. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.
- I. Protect excavations and soil adjacent to and beneath foundations from frost.
- J. Grade excavation top perimeter to prevent surface water runoff into excavations.
- K. Maintenance of existing flows:
 - 1. Keep existing sewers and drains in operation.
 - 2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.
 - 3. Do not allow raw sewage to flow on ground surface or stand in excavation.
- L. Obtain and comply with the necessary permits from the Portland Water District and City of Portland. Pay the necessary fees for Portland Water District and City of Portland. Applicable fees to be included in bid.
- M. Refer to Section 02315 for ash excavation and disposal requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subsoil: Reused, meeting the requirements of Gravel Borrow or as Common Borrow, provided they comply with the specifications below.
- B. Common Borrow: MDOT 703.18; Earth, suitable for embankment construction, free from frozen material, perishable rubbish, peat, organics and other unsuitable material, with sufficient moisture content to provide the required compaction and stable embankment, with no rocks with a maximum dimension of over 6". Moisture content shall not exceed 4 percent above optimum. Determine optimum moisture content in accordance with ASTM D698 (Cohesive Soils) or D1557 (Granular Soils).

- C. Gravel Borrow: MDOT 703.20; Mixture of sand, gravel and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand, free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 3 inch sieve shall meet the following requirements:
1. No. 40 sieve: 0 to 70 percent passing by weight.
 2. No. 200 sieve: 0 to 10 percent passing by weight.
 3. Gravel borrow shall contain no particles or fragments with a maximum dimension in excess of one-half of the compacted thickness of the layer being placed. Gravel borrow shall not contain particles of rock which will not pass the 6 inch square mesh sieve.
- D. Type B Underdrain Sand: MDOT 703.22; Granular material meeting the requirements of MDOT 703.22, Type B Underdrain Backfill, with the following limits:
1. 1 inch sieve: 95 to 100 percent passing by weight
 2. 1/2 inch sieve: 75 to 100 percent passing by weight
 3. No. 4 sieve: 50 to 100 percent passing by weight
 4. No. 20 sieve: 15 to 80 percent passing by weight
 5. No. 50 sieve: 0 to 15 percent passing by weight
 6. No. 200 sieve: 0 to 5 percent passing by weight
 7. Type B backfill shall not contain particles of rock which will not pass the 1-1/2 inch square mesh sieve.
- E. Type C Underdrain Stone: MDOT 703.22; Crushed material meeting the requirements of MDOT 703.22, Type C Crushed Stone, with the following limits:
1. 1 inch sieve: 100 percent passing by weight
 2. 3/4 inch sieve: 90 to 100 percent passing by weight
 3. 3/8 inch sieve: 0 to 75 percent passing by weight
 4. No. 4 sieve: 0 to 25 percent passing by weight
 5. No. 10 sieve: 0 to 5 percent passing by weight
- F. 2" Crushed Stone: MDOT 703.31: Crushed stone shall be obtained from rock of uniform quality and shall consist of clean, angular fragments of quarried rock, free from soft disintegrated pieces or other objectionable matter. The stone, which shall be similar to railroad ballast, shall meet the following gradation requirements in the stockpile at the source:
- | | | | |
|----|-----------|--------|---------------------------|
| 1. | 2 1/2 in. | 100 | percent passing by weight |
| 2. | 2 in. | 95-100 | percent passing by weight |
| 3. | 1 in. | 0-30 | percent passing by weight |
| 4. | 3/4 in. | 0-5 | percent passing by weight |
- G. Sand Bedding & Backfill; free of silt, clay, loam, friable or soluble materials, and organic matter.
1. Graded in accordance with the following limits:
 - a. 3/8 Inch sieve: 100 percent passing by weight
 - b. No. 4 sieve: 95 to 100 percent passing.
 - c. No. 200 sieve: 0 to 5 percent passing by weight.

2.02 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, non-woven, Mirafi 140N.
- B. Water for sprinkling: Fresh and free from oil, acid and injurious alkali or vegetable matter.
- C. Calcium Chloride: ASTM D98 commercial grade except as waived by the Owner.

2.03 SOURCE QUALITY CONTROL

- A. If tests indicate materials do not meet specified requirements, change material and retest. Materials not meeting specified requirements, if used prior to acceptance, shall be removed and replaced at no cost to Owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work.
- C. Correct unsatisfactory conditions in a manner acceptable to Owner prior to proceeding with work.
- D. Maintain in operating condition existing utilities, active utilities and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
- E. Locate, identify, and protect utilities that remain and protect from damage.
- F. Notify utility company to remove and relocate utilities.

3.02 INSPECTION

- A. Verify stockpiled fill to be reused is approved.
- B. Verify areas to be backfilled are free of organics, debris, snow, ice or water, and surfaces are not frozen.

3.03 PREPARATION

- A. When necessary, compact subgrade surfaces to density requirements for embankment, aggregate base and aggregate subbase materials.
- B. Identify known underground utilities. Stake and flag locations.
- C. Identify and flag surface and aerial utilities.
- D. Notify utility companies of work to be done.
- E. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type B Underdrain Sand Backfill if above the groundwater table, and Type C Underdrain Stone overlying geotextile fabric if below the groundwater table and compact to density equal to requirements for subsequent backfill material.
- F. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 GENERAL REQUIREMENTS

- A. Refer to Section 02315 Common Excavation, Embankment and Compaction.
- B. Provide trenching and backfilling for water service, sewerage pipes, conduits and structures. Water and sewerage lines separation shall be minimum 10 feet horizontally and 18 inches vertically. Lay all piping in open trench. Maintain access to fire hydrants by fire-fighting equipment.
- C. Sheet and brace trenches and remove water as necessary to fully protect workmen and adjacent facilities, in keeping with local regulations or, in the absence thereof, with the provisions of the "Manual of Accident Prevention in Construction," of the Associated General Contractors of America, Inc. Under no circumstances lay pipe or install appurtenances in water. Keep the trench free from water until pipe joint material has hardened. Sheeting left in place shall be cut off not less than 2 feet below finished grade. Sheeting shall not be removed until the trench is substantially backfilled.
- D. Excavation under this contract shall be unclassified.
- E. Grade the bottom of the trenches evenly to insure uniform bearing for full length of all pipes. Excavate all rock, cemented gravel, old masonry, or other hard material to at least 6 inches below the pipe at all points. Refill such space and all other cuts below grade with sand bedding

firmly compacted.

- F. Should soil conditions necessitate special supports for piping and/or appurtenances, including the removal of unsuitable material and refilling with 2" crushed stone, such work shall be performed as necessary.
- G. Backfill trenches only after piping has been inspected, tested and the locations of pipe and appurtenances have been recorded. Backfill by hand around pipe and for a depth of 1 foot above the pipe. Use common borrow or gravel borrow without rock fragments or large stones and tamp as specified in layers not exceeding 6 inches in thickness, taking care not to disturb the pipe or damage the pipe coating. Compact the remainder of the backfill as specified with a rammer of suitable weight, or with an approved mechanical tamper, provided that under pavements, walks and other surfacing, the backfill shall be tamped as specified. Exclude all cinders, rubbish and scrap metal from trenches in which metal pipes are laid. Special care shall be used to properly tamp backfill under lower half of sewer pipe.

3.05 ELECTRICAL/TELEPHONE

- A. Refer to the Handbook of Standard Requirements for Electric Service and Meter Installation for installation requirements for primary electric service, secondary electric service, telephone service and cable services. Pull ropes shall be installed in all conduits.

3.06 TRENCHING

- A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or flatter until shored. All excavations shall be consistent with OSHA requirements.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Excavate subsoil required for piping and appurtenances.
- E. Cut trenches wide enough to enable installation and allow inspection of installed utilities.
- F. Relic topsoil, if encountered in utility trenches shall be removed from beneath pipes and pipe bedding.
- G. Hand trim excavations. Remove loose matter.
- H. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.
- I. Remove excavated material that is unsuitable for re-use from site.
- J. Stockpile excavated material to be re-used in area designated on site.
- K. Correct unauthorized excavation with Sand Bedding, Type B Underdrain Sand or Type C Underdrain Stone as directed by Owner at no cost to Owner.
- L. Fill over-excavated areas under pipe bearing surfaces with Sand Bedding, Type B Underdrain Sand or Type C Underdrain Stone overlying geotextile fabric or as directed by Owner.
- M. Do not store excavated material adjacent to excavations where they could surcharge sideslopes.
- N. Remove excess excavated material from site.
- O. Surplus Material:
 - 1. Make arrangements to provide suitable disposal areas off-site
 - 2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
 - 3. Obtain any necessary permits for disposal.

4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.
5. Keep crosswalks, streets, and pavements clean and free of debris.
6. Clean up materials dropped from vehicles as often as directed by Owner.

3.07 REPAIRS TO EXISTING PIPES, CONDUIT AND WATER LINES

- A. Remove damaged or broken portions of pipe or conduit and replace with a pipe or conduit of the same size and material, unless otherwise directed by Owner, designed to serve same function as existing pipe or conduit.
- B. Make connections for repair with flexible couplings to satisfaction of Owner.
- C. Maintain inventory of suitable repair materials on site.
- D. Make repairs immediately following discovery of damage.
- E. Do not backfill until repairs have been completed to satisfaction of Owner.
- F. Repairs to water mains and services will be by the water utility. Coordination and payment for repairs shall be the responsibility of the Contractor.

3.08 BACKFILLING

- A. Place and compact bedding material to grade of underside of pipe in trench bottom as soon as excavation reaches grade.
- B. Compact bedding material to provide firm laying base.
- C. Underslab utilities shall be installed on sand bedding material and backfilled with sand backfill.
- D. After pipe is laid to grade, place bedding material uniformly on each side of pipe up to spring line while carefully compacting bedding material under haunches of pipe.
- E. Support pipe and conduit during placement and compaction of bedding fill.
- F. Place and compact base material to grade of underside of appurtenant structures in bottom of excavation as soon as excavation reaches grade.
- G. Compact base material for appurtenant structures to provide a firm laying base.
- H. Place and compact backfill materials in continuous layers not exceeding 12" in areas of paving, slabs-on-grade, and similar construction. Lift thickness not to exceed 16" in lawn or field areas.
- I. Backfill to contours and elevations indicated using unfrozen materials.
- J. Install geotextile fabric in accordance with manufacturer's recommendations and where shown on Drawings.
- K. Employ a placement method that does not disturb or damage other work or existing pipe.
- L. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- M. Maintain optimum moisture content of fill materials to attain required compaction density.
- N. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- O. Correct areas that are over-excavated.
 1. Thrust bearing surfaces: Fill with concrete.
 2. Other areas: Use common borrow in lawn areas or granular borrow in paved/building areas, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- P. Leave stockpile areas completely free of excess fill materials.

- Q. Upon completion of backfilling in paved areas, sweep undisturbed pavement.
- R. Upon request of Owner implement the following dust control measures during the interim period between backfilling and capping of the trench:
 - 1. Apply water and calcium chloride as directed by Owner.
 - 2. Spread calcium chloride uniformly over designated areas.
 - 3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.
- S. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.
- T. Reshape and re-compact fills subjected to vehicular traffic.

3.09 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.10 FIELD QUALITY CONTROL

- A. Compaction density testing will be performed by Owner on compacted fill in accordance with ASTM D2922.
- B. Evaluate compaction results in relation to compaction curves determined by ASTM D 698 ("standard Proctor") or ASTM D 1557 ("modified Proctor") as appropriate for soil type.
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.
- D. Frequency of Tests: 1 test for each 200'-0" of trench for the first and every other lift of compacted trench backfill not including pipe bedding.

3.11 CLEAN-UP

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION