SECTION 312000 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

B. Borrow or Select Borrow: Satisfactory soil material used for embankment, backfill, or fill construction that is either imported from off-site or excavated from designated locations at the site.

C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Contracting Officer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction of the Contracting Officer. Unauthorized excavation, as well as remedial work directed by Contracting Officer, shall be without additional compensation.
3. Unclassified Excavation: Excavation to subgrade elevation and to lines and dimensions indicated regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

D. Fill: Soil materials used to raise existing grades.

E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

F. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, aggregate base, drainage fill, initial or subsequent backfill, or topsoil materials.

G. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building.

1.3 SUBMITTALS

A. Contractor shall submit to the Contracting Officer for approval source of aggregates and backfill materials and certified sieve analysis. Materials from Government Sources are exempt from this requirement.

B. Product Data: For the following:

1. Drainage fabric.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted in writing by Contracting Officer and then only after arranging to provide temporary utility services according to requirements indicated:

1. Do not proceed with utility interruptions without Contracting Officer's written permission.

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.

1.5 MEASUREMENT AND PAYMENT

A. There will be no separate measurement or payment for work in this Section

1. All Other Work: There will be no separate measurement or payment for other work in this Section. Payment will be included in the contract unit price as shown on the Schedule of Items for the building.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS, GENERAL

A. Excavated material may be processed and used for backfill if the Contractor can show compliance with the material specified herein to the satisfaction of the Contracting Officer. If excavated material is not sufficient to meet requirements, Contractor shall import needed material.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

1. Remove rocks over 8 inches in maximum dimension, ice or frozen earth, muck, debris, and earth with high void content.
2. Remove rocks over 4 inches in maximum dimension for backfill placed within 12 inches of foundation.

2.2 BACKFILL MATERIALS, UTILITY TRENCHES

A. Pipe Zone Material

1. Backfill material for electrical cable and all types of pipe, except ductile iron pipe and galvanized steel pipe, shall consist of soil, sand, or fine granular material free of ¾ inch or larger stones, and free of organic material.
2. Backfill material for all ductile iron or galvanized steel pipe shall consist of soil, sand, or rock smaller than two inches in largest dimension and free of organic material.
3. Frozen material will not be allowed.
4. Backfill material shall be trench-excavated material whenever it meets specification requirements. Whenever material meeting the requirements for pipe zone backfill is not readily available from trench excavation, the Contractor will be required to import pipe zone material from a designated or approved source. Imported pipe zone material shall be paid for as such.

B. Above-Pipe-Zone Material

1. Backfill material shall be free from brush, perishable material, trash, rocks, or boulders larger than 6 inches in greatest dimension, or frozen material.
2. Backfill material shall be trench-excavated material whenever it meets specification requirements. Whenever trench excavated material contains less than 10 percent of oversized material, the Contractor will be required to remove rocks larger than 6 inches from the trench excavated material at no additional compensation and utilize it as backfill material. If, after all suitable trench excavated material has been used as backfill, the trench is not filled to the required grade, the Contractor shall delay his backfill operations until the Contracting Officer can obtain profile elevations of the top of the partially filled trench. These elevations shall be used in computing the cubic yards for which payment will be made for imported material. Whenever material meeting the specification requirements for backfill above the pipe zone is not available from trench excavation, the Contractor will be required to import material from a designated or approved source. Imported above-pipe-zone material shall be paid for as such.

PART 3 - EXECUTION

3.1 LOCATION, ALIGNMENT AND GRADE

A. The location of all structures shall be staked out and grades established by the Contractor. Locations shall be approved by the Contracting Officer before excavation is started.

3.2 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.

3.3 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.

3.4 EXPLOSIVES

A. Do not use explosives.

3.5 EXCAVATION SUPPORT AND PROTECTION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation.

B. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and resisting soil and hydrostatic pressures and superimposed and construction loads.

C. The contractor shall meet State General Safety Orders and the provisions of the Occupational Safety and Health Administration (OSHA) pertaining to excavation support and protection, including 29 CFR 1926 Subpart P.

D. Walls of excavations 5 feet or more in depth shall be supported by shoring and bracing methods or the walls shall be sloped at one and a half to one.

E. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

3.6 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Topsoil shall be removed from the area to be excavated and from the area where excavated material will be piled, prior to excavation. Topsoil shall be stored as specified below.

C. Maintain the excavations to guard against and prevent injury to employees and the public. Provide adequate shoring and bracing as required by OSHA and other local governing regulations.

D. Excavations left open at the end of the working day shall be fenced to protect the public.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. All trench excavation shall conform, as near as possible, to the lines and grades illustrated on the drawings.

B. Classification of Excavation Material - Excavation will be unclassified as to materials and shall include all materials which are encountered in the required excavation. Any information that has been obtained by the USDA Forest Service concerning possible ground conditions is available at the Supervisor's Office for the Forest where the project is located to interested parties upon request.

C. Unsatisfactory Material - During excavation, if material which does not meet the backfill requirements of Article 2 (such as structurally unstable material, solid rock, over-sized rock, angular or sharp rock), as determined by the Contracting Officer, is encountered at the grade line for the pipe or cable, the unsatisfactory material shall be removed to a minimum depth of 6 inches below the utility line. Trenching shall be performed by any acceptable method, including the use of explosives, as permitted by the Contract General Provisions. In addition to the General Provisions, the Contractor shall provide skilled blasting operators and precautions shall be taken to avoid damage to adjacent property.

D. Trenching by Machine or by Hand - The use of trench digging machines will be permitted except in places where machines may cause damage to existing structures, utilities, or trees, in which case hand methods shall be employed. Areas specifically to be trenched by hand will be as indicated on the drawings and paid for separately. Machines shall be of the proper size to operate within the specified working limits. In areas being excavated by machine, any hand digging necessary to locate or cross utilities will not be paid for as hand trenching.

E. Depth - Trench excavation shall provide a uniform (for all utilities) or gently changing (for all utilities except gravity flow sewer lines) flow line.

F. Width of Trenches - The bottom width that will be used in arriving at pay quantities that are paid on the basis of volume shall be the design bottom width, as shown on the Schedule of Items, or as shown on the trench cross-section detail on the drawings. The width of trench allowed when computing excavation and/or backfill quantities shall be vertical lines for trenches less than 4 feet and for trenches greater than 4 feet shall be computed on 1/2 to 1 side slopes. In circumstances where trench sides will not stand or

are not considered safe when sloped at 1/2 to 1, a slope will be determined in the field by the Contracting Officer for which pay quantities will be computed, and the slopes shall be laid back to the stable slope determined.

G. The Contractor may excavate the trench narrower or wider than the design width shown on the drawings; however, the design width of the trench will be used to calculate the number of cubic yards of all excavated volume and volume of imported material that is paid for by unit volume.

H. Any over excavation (width) performed by the Contractor for his convenience shall be at his own expense.

I. Alignment and Grade - The location of all pipelines and structures will be staked out and grades established by the Contracting Officer before excavation is started. All trenches shall conform with the lines and grades illustrated on the drawings or staked on the ground. The Contractor shall set batter boards and shall establish grade lines and levels necessary for the work from dimensions and elevations shown on the drawings and as established in the field. Any shifting or change from the indicated alignment and grade must receive prior approval by the Contracting Officer in writing. Alignment and grade shall also meet the requirements of Sections governing the utilities which are being installed in the trench.

3.8 APPROVAL OF SUBGRADE

A. Notify Contracting Officer when excavations have reached required subgrade.

B. If Contracting Officer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Contracting Officer.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Contracting Officer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Contracting Officer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile, borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. 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.

B. Topsoil shall be kept separate from trench-excavated material by either stockpiling or by windrowing on the opposite side of the trench from which the trench excavated material will be placed. Topsoil will be reused after backfilling on those areas from which it came.

3.11 UTILITY TRENCH BACKFILL

A. Backfilling will be permitted only after all inspections of piping and/or cable have been performed and tests completed and the work to be covered has been approved by the Contracting Officer. Backfill which has been improperly placed and/or compacted shall be corrected, if directed by the Contracting Officer, by reopening the trench to the depth required to obtain proper compaction. Then the trench shall be refilled and compacted according to specifications.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Backfill at Pipe Zone

1. Any backfill in trench bottom where over excavation was performed by the Contractor for his convenience, shall be brought back to the pipe grade indicated at his own expense. If the trench bottom is prepared in wet conditions, special bedding conforming to Article 2 shall be used if determined necessary by the Contracting Officer.
2. The bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe along its entire length, except for portions of the pipe sections where it is necessary to excavate for pipe joints. Depressions for joints shall be made in accordance with the recommendations of the manufacturers for the particular joint used. The bedding shall be a minimum of 6 inches in depth under the pipe and be of either special bedding or pipe zone material as conditions dictate. Trench bottom preparation shall be such that when final placement of pipe has been made, pipe will be true to line and grade. All adjustment to line and grade shall be made by scraping away or filling in with pipe zone material or special bedding material, as conditions dictate, under the body of the pipe and not by wedging or blocking.
3. After pipe is placed as called for in applicable Sections governing the utilities being placed in the trench, pipe zone material shall be deposited in the trench uniformly on both sides of the pipe for the full width of the trench in 6-inch horizontal layers (loose measurement) and compacted from the bottom of the trench to a depth of 1 foot over the top of the pipe.
4. An exception to this is on water lines and sewer lines where the Contractor elects to hydrostatically pressure test the pipe. Joints, couplings, fittings, and valves shall then be left uncovered until after the pipe has been tested. After testing proves the pipe installation to be satisfactory, pipe zone material shall then be placed carefully and compacted around the joints, couplings, fittings, and valves to a depth of 1 foot above the pipe, after which the remainder of the trench shall be backfilled. On gravity flow sewer lines, the Contractor may elect to pressure test the pipe with air.

In this case, the entire trench is to be properly backfilled prior to the acceptance test.

5. Where electrical conduit is buried in the same trench as the waterline or sewer line, the backfill procedure for the conduit shall be performed as outlined in the preceding paragraphs. Location with respect to other utilities in a trench shall be as indicated on the trench cross-section detail as shown on the drawings.
6. When an electrical conduit is buried singly in a trench, or if only conduit is buried in a trench, the bedding shall be a minimum of 2 inches in depth under the conduit. After the conduit is placed, pipe zone material shall be deposited in the trench uniformly for the full width of the trench and compacted from the bottom of the trench to a depth of 4 inches over the top of the conduit.
7. **Compaction and Testing**: All compaction within the pipe zone (electrical conduit area is considered as pipe zone), shall meet the following: Material shall be compacted to not less than 95 percent of the maximum dry unit weight, as determined by AASHTO T 99, Method D, or ASTM D 698, Method D. Ascertain adequate compaction during the backfill operation by performing in-place density tests in accordance with one or more of the following standard test procedures: ASTM D 1556, D 2167, or D 2922, or AASHTO T 191, or T 205.

D. Backfill Above-Pipe-Zone

1. When shown on the drawings as being required, marking tape shall be installed eight inches below the ground surface and shall run the full length of the trenches.
2. Backfill in trenches in areas other than under roadways and parking areas shall be placed in horizontal layers 12inches thick or less (loose measurement). Layers shall be compacted before the succeeding lift is placed with at least three passes of an approved mechanical compaction device.
3. **Compaction and Testing**: Backfill in trenches under roadways and parking areas shall be maintained, wetted, or dried to optimum moisture for maximum compaction, placed in the trench in horizontal layers not to exceed 6 inches in thickness (loose measurement), and compacted to not less than 95 percent of maximum dry unit weight, as determined by AASHTO T 99, Method D, of ASTM D 698, Method D. Ascertain adequate compaction during the backfill operation by performing in-place density tests in accordance with one or more of the following standard test procedures: ASTM D 1556, D 2167, or D 2922, or AASHTO T 191, or T 205.

E. Imported Material

1. Any trench excavated material that can be transported less than 300 feet to other areas along the trench and used, in accordance with specifications, shall not be considered as imported material. When the Contractor is required to import material, it shall be from a designated or approved source.

F. Trenches in Embankments

1. When pipelines are to be placed in trenches excavated in embankments, the excavation of each trench shall be performed after the embankment has been

constructed to an elevation at least 3 feet over the pipe or to finish grade, whichever is least.

G. Surface Restoration in Areas Other Than Roads

1. All surfaces shall be restored to the required grade (usually original ground line), mounded over or smoothed off as directed, and left in a uniform and neat condition, to the satisfaction of the Contracting Officer. Surface drainage shall be diverted so that it will not flow along a trench. In areas where natural revegetation is designated (no planting to be done), the Contractor shall scarify all disturbed or compacted areas and right-of-ways such that the surface of the ground is loose to a depth of at least one inch. In areas to be seeded, the area shall be prepared in accordance with Section 329206 "Seeding."

3.12 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under sidewalks, concrete slabs and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under utility buildings, use engineered fill or fill according to Section 133400 "Precast Concrete Utility Building."
6. Under water storage tanks, use fill according to Section 221200 "Underground Water Storage Tank."
7. Under septic tanks, use engineered fill.
8. Under footings and foundations, use engineered fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill 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.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. The minimum degree of compaction required shall be a percent of the maximum laboratory density obtained by the standard proctor test AASHTO T99 or ASTM D698.

The in-place field density shall be determined by AASHTTO T238 or ASTM D2922. The minimum compaction requirements are:

1. For Utility Trenches, see "Utility Trench Backfill" article above.
2. Under structures, buildings, water and septic tanks, utility boxes, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.
4. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from 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.

B. Finishing Slopes: Finished slopes shall conform reasonably to the lines staked on the ground or shown on the drawings. The finished slope shall be left in a roughened condition to facilitate the establishment of vegetative growth. The finish associated with template and stringline or hand-raking methods will not be allowed.

3.16 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 specify 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 Contracting Officer, 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 the greatest extent possible.

3.17 SURFACE FINISH

A. In unpaved areas all surfaces shall be restored to the original ground line or elevations shown on the drawings and left in a uniform and neat condition. Any stockpiled topsoil shall be smoothly distributed over disturbed areas to elevations shown on the drawings.

B. In paved areas, apply surface treatment as specified and shown on the drawings.

END OF SECTION 312000
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