

SECTION 02310
EARTHWORK

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 slabs-on-grade, walks, pavements, lawns, and plantings.
- 2. Excavating and backfilling trenches within building lines.
- 3. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

- B. Related Sections include the following

- 1. Division 1 Section "Construction Facilities and Temporary Controls."
- 2. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
- 3. Division 3 Section "Cast-in-Place Concrete" for sub-grade preparation.
- 4. Division 15 and 16 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil materials 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. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

- D. Competent Person – Means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

- E. Excavation: Removal of material encountered above subgrade elevations.

- 1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. 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.
- H. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- I. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase or topsoil materials.
- J. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Competent Person – Copies of current certificates and/or a certified letter stating the name and authority of the Competent Person.
- 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 on-site or borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

- A. Bidders shall inform themselves of location and nature of work, character of equipment and facilities needed for performance of work, general and local conditions prevailing at site, and other matters which may in any way affect work under this contract in accordance with Division 0, Bidding Requirements, Contract And Conditions Of The Contract.

- B. Site Information: Data in the subsurface investigation report was used for the basis of the design. The report is available for review. Conditions are not intended as representations or warranties of accuracy or continuity between soil. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
- C. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- D. For excavations in excess of four (4) feet in depth, Contractor shall comply with all local, state and OSHA Safety requirements and provide a Competent Person to oversee all work in trenches four (4) foot in depth or greater.
- E. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- F. 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. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups SW, SW-SM, SP-SM, and SP, or a combination of these group symbols; free of rock or gravel larger than three (3) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter, with not more than 10-percent by weight passing the No. 200 sieve.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GM, GC, SM, 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.
- E. Subbase: 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 5-percent passing a No. 200 sieve.

- F. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100-percent passing a 1-inch sieve and not more than 10-percent passing a No. 200 sieve.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Required for all new installations shall be acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum six (6) inches wide and four (4) mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications, including Cable TV.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 200 lbf; ASTM D 4632.
 - 2. Tear Strength: 75 lbf; ASTM D 4533.
 - 3. Puncture Resistance: 90 lbf; ASTM D 4833.
 - 4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D 4491.
 - 5. Apparent Opening Size: No. 30; ASTM D 4751.

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. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with the Storm Water Pollution Prevention Plan (SWPPP) including all permits/requirements of the State of Florida Department of Environmental Protection (EPA), Saint Johns River Water Management District (SJRWMD), City of Melbourne and Brevard County.
- C. Clear and strip all surface vegetation, topsoil, roots, grass, organics, stumps, demolition debris, and other deleterious material from proposed structure and pavement areas and a minimum margin of five (5) feet.

- D. Proof-roll soils at the stripped surface in the building and pavement areas with a drum roller until densities equivalent to at least 95-percent of the Modified Proctor maximum dry density (ASTM D 1557) are uniformly obtained to a depth of at least 1 foot below the subgrade in building and pavement areas. Any areas that yield during the proof-rolling operation or areas of deleterious material that are exposed during proof-rolling operation shall be over excavated, compacted, and replaced with compacted satisfactory material. The bottom of the excavation shall be compacted to 95-percent of the Modified Proctor minimum dry density. Satisfactory material shall be placed in lifts not exceeding 12 inches in loose thickness. Thoroughly compact each lift with the vibratory roller until densities equivalent to at least 95-percent of the Modified Proctor maximum dry density are uniformly obtained. Prior to compaction, document condition of adjacent structures. Vibratory compactors shall not be used within 75 feet of existing structures. Compaction shall cease if deemed harmful to adjacent structures.
- E. Comply with all local, state and OSHA Safety requirements and provide a Competent Person to oversee all work in trenches four (4) foot in depth or greater.

3.2 DEWATERING

- A. Contractor shall familiarize themselves with the nature of the work, character of equipment and facilities needed for performance of work, general and local conditions prevailing at site including the underground water table. Data in the subsurface investigation report is available for review. Conditions are not intended as representations or warranties of accuracy for the depth of the underground water table. However, the Contractor shall make reasonable interpretations and provide for dewatering costs in their bids and/or proposals.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. 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.

3.4 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.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. The Contractor shall design and impliment a Trench Safety system that complies with OSHA Standard 29CFR, Section 1926.650, Subpart P. Contractor shall submit a written assurance of compliance.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus one (1) inch. 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 Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus one (1) inch. Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Provide dewatering measures where needed to prevent trench wall failure and to provide for proper installation of piping.
- B. Excavate trenches to uniform widths to provide a working 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: 12 inches on each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than six (6) inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit six (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. For culvert pipe laid in bottom of trench: Remove organic materials and shape bottom of trench to support pipe. Install pipe so that invert of pipe is level with the bottom of the flow line.
4. Excavate trenches six (6) inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 PREPARATION AND APPROVAL OF SUBGRADE

- A. Any roots or other deleterious materials found within the excavation shall be removed.
- B. Notify Owner's Representative when excavations have reached required subgrade.
- C. If Owner's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Representative.

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 Owner's Representative.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by Owner's Representative.

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.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for record documents.

3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. 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.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Provide four-inch thick, concrete base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of four (4) inches of concrete before backfilling or placing roadway subbase.
- D. Place and compact initial backfill of subbase material, free of particles larger than one (1) inch, to a height of 12 inches over the utility pipe or conduit.
 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except six (6) inches below subgrade under pavements and slabs.

3.13 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 one (1) vertical to four (4) horizontal so fill material will bond with existing material.
- C. 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 pavement, use satisfactory soil material.
 3. Under steps and ramps, use satisfactory soil material.
 4. Under building slabs, use satisfactory soil material.

5. Under footings and foundations, use satisfactory soil material.

3.14 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.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than six (6) inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
- D. Under structures, building slabs, steps, and foundations, scarify and recompact top 24 inches of existing subgrade and each layer of backfill or fill material at 95-percent.
- E. Under walkways, scarify and recompact top six (6) inches below subgrade and compact each layer of backfill or fill material at 95-percent.
- F. Under lawn or unpaved areas, scarify and recompact top six (6) inches below subgrade and compact each layer of backfill or fill material at 90-percent.
- G. Compact pavement subgrades to a density of at least 98-percent of the Modified Proctor maximum dry density to a depth of at least 12 inches below the pavement base.

3.16 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.
 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 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2-inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2-inch when tested with a ten-foot straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course on prepared subgrade and as follows
1. Place base course material over subbase.
 2. Compact subbase and base courses 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 1557.
 3. Shape subbase and base to required crown elevations and cross-slope grades.
 4. When thickness of compacted subbase or base course is six (6) inches or less, place materials in a single layer.
 5. When thickness of compacted subbase or base course exceeds six (6) inches, place materials in equal layers, with no layer more than six (6) inches thick or less than three (3) inches thick when compacted.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: Unless noted otherwise in the Contract Documents, the Contractor shall engage and pay for 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 complies 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 and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Column and Wall Foundations: At each compacted backfill layer, at least one test for every column foundation and one test for each 50 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 100 feet or less of trench length, but no fewer than two 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.
- E. Following completion of absorption ponds construction, testing agency shall test the in-place material at one location in each pond for conformity with permeability specification. If the

specified permeability rate is not met, Contractor shall remove and replace the soil material and retest until the specified permeability rate is met.

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 Architect; 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.

3.20 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 02310