

SECTION 02200
EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing sub-grades for slabs-on-grade, foundations, walks, pavements, and lawns.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Excavating and backfilling trenches within building lines.
 - 4. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for 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 sub-grade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Excavation: Removal of material encountered above sub-grade elevations.
 - 1. Additional Excavation: Excavation below sub-grade elevations as directed by Owner. Additional work paid per contract provisions.
 - 2. Bulk Excavation: Excavations more than 10' wide and pits more than 30' length or width.
 - 3. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.
- E. Fill: Soil materials used to raise existing grades.
- F. Rock: Rock material in beds, ledges, un-stratified masses, and conglomerate deposits and boulders or rock material $\frac{3}{4}$ -cy. or more in volume that when tested by an independent geo-technical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2".
- 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. Sub-grade: Surface or elevation remaining after completing excavating, or top surface of a fill or backfill immediately below base or topsoil materials.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. 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. Geo-technical Testing Agency Qualifications: Owner will engage and pay for an independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
 3. Contact utility-locator service before excavating. (Sunshine 1-800-432-4770)
- B. Demolish and completely remove from site existing underground utilities indicated for removal. Coordinate with utility companies to shut off services if lines are active.

1.7 TRENCH SAFETY

- A. In accordance with Florida Statute 553.63, trench excavations in excess of 5' deep shall require the Contractor to submit in writing:
 1. Reference to the trench safety standards that will be in effect during the period of construction of the project.
 2. Written assurance that Contractor will comply with the applicable trench safety standards.
 3. Identify the cost of compliance with the applicable trench safety standards.
- B. As a minimum the Contractor shall:
 1. Comply with the excavation safety standards applicable to the project.
 2. Adhere to any special shoring requirement, which may be applicable to such a project.

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 GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3" 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% of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.

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- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; maximum material size of 3" with at least 95% passing a 1-1/2" sieve and not more than 5% 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% passing a 1" sieve and not more than 8% passing a No. 200 sieve.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid and alkali resistant polyethylene film warning tape manufactured for making and identifying underground utilities, minimum 6" wide and 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" deep; colored 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
 - 6. Purple: Reclaimed water system

2.3 CONCRETE

- A. Concrete formulation using type I cement and having a 28-day compressive strength of at least 3,000 psi.

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.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.
- B. Protect sub-grades 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 sub-grades dry and convey ground water away from excavations. Maintain until dewatering is no longer required. Draw down the water table 1' below the bottom of any excavation or compaction surface.
- C. Comply with South Florida Water Management District requirements for dewatering systems.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to sub-grade elevations regardless of the character of surface and sub-surface 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.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to required elevations and dimensions within a tolerance of plus or minus 1". 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 1". Do not disturb bottom of excavations intended for bearing surface.
- B. Use the following building pad preparation procedures to achieve the required design soil bearing pressure.
 - 1. Cleaning and grubbing shall consist of the complete removal of all trees, roots, stumps, grass, shrubbery, rubbish, building materials, and debris on the surface of the ground or beneath the surface of the ground or the excavated areas or beneath the excavated areas.
 - a. Rubbish, etc., if found, shall be removed entirely at whatever depth found.
 - b. Roots, 2" and larger shall be removed to a depth of 4' below the surface, below the bottom of the excavation or below the bottom of the footing.
 - c. Roots less than 2" shall be removed to a depth of 2' below the bottom of the footing and do not use in any fill.
 - d. The cleaning and grubbing area shall extend outside the building pad areas by 5' in all directions.
 - 2. Excavate the entire building pad, plus 5', to 4' below the existing grade, unless the geotechnical report identifies other limits.

3.6 EXCAVATION FOR WALKS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- 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" higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12" on each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4" deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 - 1. Excavate trenches 6" deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 APPROVAL OF SUB-GRADE

- A. Notify Owner when excavations have reached required sub-grade.
- B. If Owner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material paid per contract provisions.
- C. Proof roll sub-grade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated sub-grades.
- D. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner.

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.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Owner.

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 damp-proofing, 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" of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Provide 4" thick, concrete-base slab support for piping or conduit less than 30" below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4" of concrete before backfilling or placing roadway sub-base.
- D. Place and compact initial backfill of sub-base material, with soil with no more than 8% passing the No. 200 sieve, with a maximum particle size of 1". The trench backfill shall be placed in

maximum loose lifts of 6" and compacted to at least 98% of the modified Proctor maximum dry density, to a height of 12" over the utility pipe or conduit.

1. Carefully compact material under pipe haunches bringing backfill up evenly on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utilities.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while removing sheeting, shoring and bracing.
- G. Place and compact final backfill of satisfactory soil material to final sub-grade.
- H. Install warning tape directly above utilities, 12" below finished grade, except 6" below sub-grade 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 surface steeper than 1 vertical to 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 building slabs, use engineered fill.
 2. Under footings and foundations, use engineered fill.
 3. Under grass and planted areas, use satisfactory soil material.
 4. Under walks, use engineered fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill layer before compaction to within 2% 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% and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Following building pad preparation procedures and, perform the following:
 1. Provide soil compaction using a 20-ton self-propelled non-vibratory roller to provide 98% compaction to a depth of 2' below the surface.
 - a. Subject each section of the building sub-grade to at least ten overlapping (20% overlap) passes of the compactor traveling at a speed of no more than 1.5 MPH.
 - b. Densification operations shall continue until no further settlement is visually discernible at the excavation bottom and the in-site soils at the cut grade are compacted to 98% of the ASTM D 1557 maximum dry density.
 - c. Frequent wetting of the rolled sub-grade may be necessary to prevent drying and loosening of the upper 6" to 12" of soil.
 - d. Contractor shall monitor nearby structures before and during proof-compaction operations, taking care to ensure that vibrations induced by the compaction operations does not cause any distress to nearby structures.
 2. Structural fill to raise the site to the design building grades shall be placed in thin lifts (12" thick loose measure), near the optimum moisture content for compaction, and compacted to at least 98% of maximum dry density (ASTM D 1557).
 3. A SDPBC building inspector shall inspect the footing excavation bottoms. Compact the footing bottoms to 98% of the ASTM D1557 maximum dry density. Completely remove any

soft or organic soils detected in the footing bottoms, and replaced with clean granular fill compacted to the degree specified above.

- B. Place backfill and fill materials in layers not more than 12" in loose depth for material compacted by heavy compaction equipment, and not more than 6" in loose depth for material compacted by hand-operated tampers.
- C. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

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 sub-grades to required elevations within the following tolerances:
 - 1. Lawn, Walks, or Unpaved Areas: Plus or minus 1".
- C. Grading inside Building Lines: Finish sub-grades to a tolerance of ½" when tested with a 10' straightedge.

3.17 FIELD QUALITY CONTROL

- A. Soil Borings: If the School District did not provide soil borings for this site, the Contractor shall take a series of standard split spoon soil borings to ascertain the sub-surface soil conditions to verify the acceptability of the sub-grade to support the 2500 psf bearing capacity noted.
- B. Testing Agency: Owner will engage a qualified independent geo-technical engineering testing agency to perform field quality- control testing.
- C. Testing agency to inspect and test sub-grades and each fill or backfill layer. Contractor may proceed with subsequent earthwork only after test results for previously completed works comply with requirements.
- D. 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. Building Slab Areas: At sub-grade and at each compacted fill and backfill lift, at least one test for every 2500 SF per lift or less of building slab, but in no case fewer than five tests.
 - 2. Foundation Backfill: At each compacted backfill lift, at least one test for each column footings, but no fewer than two tests. One compaction test per 50 linear feet of wall footing with a minimum of one density test per perimeter wall footing.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 100' or less of trench length, but no fewer than two tests.
 - 4. General Fill: One density test per 5,000 SF of fill per lift.
- E. When testing agency reports that sub-grades, fills, or backfills do not achieve the degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil to depth required, re-compact and retest until specified compaction is obtained. Correction of failing work shall occur without additional cost to the owner. Contractor shall reimburse Owner for all re-testing costs due to failed tests.

3.18 PROTECTION

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- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish 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 Owner; reshape and re-compact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and re-construct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 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 02200