SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work Includes: All excavating, filling, backfilling, removal of materials, shoring and bracing, and dewatering.

Earthwork for utilities is included in this section.

B. Contractor will be responsible for all layout. Engineers have used Daniel J. Dalfonso, South Portland, Maine, during design phase.

1.02 PROTECTION:

A. Paved Surfaces: Do not operate equipment on paved surfaces which will damage these surfaces.

B. Maintain excavations with approved barricades, lights, and signs to protect life and property until excavation is filled and graded to a condition acceptable to the Engineer.

C. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

D. Rock Excavation: It is not anticipated for this project.

1.03 QUALITY ASSURANCE:

A. Testing and Inspection Service by Contractor: Employ, at Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

1.04 SUBMITTALS:

A. Test Reports: Submit the following reports:

- Reports on Material Gradations
- Verification of each footing subgrade
- Field density test reports
- One optimum moisture-maximum density curve for each type of soil encountered
- Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested

1.05 JOB CONDITIONS:

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil test pits. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for convenience of Contractor. Additional test pits and other exploratory operations may be made by Contractor at no cost to Owner.

B. Existing Utilities: Locate existing utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult Owner immediately for directions. Cooperate with Owner in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Owner.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with Owner for shutoff of services if lines are active.

C. Use of Explosives: Not permitted; see Part 3- Execution for requirements.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General:

1. Suitable Materials: Materials shown on the Drawings, or specified herein.

2. Unsuitable Materials: Materials containing clay, vegetation, organic matter, debris, pavement, stones, or boulders over 6 inches in greatest dimension, and frozen material. Any material which, in the opinion of the Engineer, will not provide a suitable foundation or subgrade.

3. On-Site Materials: Any suitable material from on-site excavation.

4. Material for embankments and general fills may contain pieces of excavated ledge having a greatest dimension of up to 12 inches if approved by the Engineer.

5. Inspection: The Engineer may inspect off-site sources of materials and order tests of these materials to verify compliance with these specifications.

B. Gravel: Hard, durable stone with coarse to fine sand. Sieve analysis by weight:

Sieve Size	% Passing
3”	100
1/4”	30 - 70
40	0 - 30
200	0 - 5

C. Sand: Sieve analysis by weight:

Sieve Size	% Passing
3/8”	100
No. 4	95 - 100
No. 16	50 - 85
No. 100	2 - 10

D. 3/4" Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. Sieve analysis by weight:

Sieve Size	% Passing
1”	100
3/4"	95-100
1/2"	35-70
3/8”	0-25

E. Pea Stone: Naturally round aggregate, 1/4" nominal size. Sieve analysis by weight:

Sieve Size	% Passing
3/8”	100
No. 10	0-10
No. 200	0-2

F. Aggregate Base: Hard, durable crushed gravel, containing only particles passing the 2” sieve. Sieve analysis by weight:

Sieve Size	% Passing
1/2"	45-70
1/4"	30-55
No. 40	0-20
No. 200	0-5

G. Aggregate Subbase: Hard durable gravel containing only particles passing the 6" sieve. Sieve analysis for portion passing 3 inch sieve:

Sieve Size	% Passing
1/4"	95-100
1/2"	75-100
No. 4	50-100
No. 20	15-80
No. 50	0-15
No. 200	0-5

Aggregate for base shall not contain any particle which will not pass the 2-inch square sieve.

H. Refill Material: Crushed stone for refilling excavation below grade or rock excavation unless otherwise directed by the Engineer.

I. Granular Fill: Sand or gravel.

J. Select Backfill: Use gravel as specified above.

PART 3 - EXECUTION

3.01 EXCAVATION:

A. General: Remove all materials encountered to the limits shown on the drawings, or designated in the specifications.

B. Classifications: The following classifications of excavation may be made which will be paid for on a unit cost basis.

All earthwork to be completed on a lump sum basis.

C. Classifications: Excavation will be classified as earth excavation or rock excavation when unanticipated rock excavation is encountered in work.

Do not perform rock excavation until material to be excavated has been cross-sectioned and classified by Engineer. Rock excavation will be paid on basis of contract conditions relative to changes in work.

D. Earth Excavation: Removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

E. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus of minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

F. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations, and grades as shown.

G. Excavation in Paved Areas: Cut pavement prior to excavation to provide a clean, uniform edge. Minimize disturbance of remaining pavement. Cut and remove the minimum amount of pavement required to do the work.

Use shoring and bracing where sides of excavation will not stand without undermining pavement.

H. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room.

Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

I. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, including refilling, is at Contractor's expense.

J. Refilling Unauthorized Excavation:

1. Trenches: Use crushed stone or gravel.

2. Earth Excavation for Structures: Use gravel.

3. Elsewhere: Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

K. Excavation Below Grade: When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions. If unsuitable materials exist at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Engineer.

Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

L. Material Storage: Stockpile suitable excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations.

3.02 STABILITY OF EXCAVATIONS:

A. General: Slope sides of excavations to comply with OSHA regulations and local codes. Shore and brace where sloping is not possible.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

B. Shoring and Bracing: Provide materials for shoring and bracing to comply with OSHA requirements and local codes.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

3.03 DEWATERING:

A. General: Perform all work in the dry. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Provide and maintain pumps and dewatering system components necessary to convey water away from excavations.

Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

B. Payment: Costs of dewatering are incidental to other work. No payment will be made for dewatering, including dewatering required for excavation below normal grade.

3.04 BACKFILL AND FILL:

A. General: Place acceptable soil material in layers to required elevations as shown on the Drawings and as listed below.

Fill, backfill, and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material. Place material in approximately horizontal layers beginning at lowest area to be filled. Do not impair natural drainage.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade, including dampening, waterproofing, and perimeter insulation.

Inspection, testing, approval, and recording locations of underground utilities and pipe.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

Removal of trash and debris.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

Use care in backfilling to avoid damage or displacement of underground structures and pipe.

C. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of materials. Plow, strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under “Compaction” for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Placement: 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. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures to required elevations. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.

Backfill cast-in-place concrete structures when the concrete has developed adequate strength. Do not allow heavy machinery within 5 feet of structure during backfilling and compacting.

E. Pipe Bedding: Bed pipe in crushed stone.

Trenches in cross-country runs: Restore surface to that existing prior to construction. Mound trench 6 inches above existing grade if required by the Engineer.

F. Replacement of Unsuitable Materials:

1. Below Normal Grade: See Paragraph 3.01

2. Above Normal Grade: Replace unsuitable material with suitable on-site material or common borrow. If additional material is required, use Select Backfill. Payment for Select Backfill will be made on the basis of contract conditions relative to change in the work.

3.05 COMPACTION:

A. Methods: Use methods which produce the required degree of compaction throughout the entire depth of material placed without damage to new or existing facilities and which are approved by the Engineer. Adjust moisture content of soil as required. Remove and replace material which is too wet to compact to required density.

B. Degree of Compaction: Compact to the following minimum densities:

Fill & Backfill Location	Density
Under Structure Foundations and slabs	95% of max.
Top 2 Feet Under Pavement	95%
Below Top 2 Feet Under Pavement	93%
Trenches Through Unpaved Areas	90%
Embankments	90%
Pipe Bedding	90%
Within 10 Feet of Structure Foundation Walls, Tank Walls, & Retaining Walls	91-93%

Maximum Density: ASTM D1557, modified

Field Density Tests: ASTM D1556 (sand cone), ASTM D2167 (rubber balloon), or ASTM D2922 (nuclear)

C. Testing: Determine actual in-place densities using field tests as directed by the Engineer. Tests will be made by an independent laboratory. Costs for tests will be paid by Contractor.

Perform additional work to obtain proper compaction if in-place densities do not meet the specified densities. Retesting may be required by the Engineer.

D. Minimum Number of Tests:

1. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be related tested strata, when acceptable to Engineer.

2. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 5,000 square feet of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 5,000 square feet of overlaying building slab or paved area, but in no case less than 3 tests.

3. Foundation Wall Backfill Outside of Structure: Make at least two field density tests at locations and elevations as directed.

4. Compaction at Retaining Walls: Compact behind and within 10' of retaining walls using small portable equipment. Do not overcompact.

3.06 GRADING:

A. Grading: Uniformly grade areas within limits of grading, including adjacent transition areas. Smooth finished surface within specified tolerances and compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to structure line to drain away from structures and to prevent ponding.

C. Finish surfaces free from irregular surface changes as follows:

1. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.

2. Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

3. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10’ above or below required subgrade elevations.

4. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10’ above or below required subgrade elevation.

D. Compaction: After grading, compact subgrade surfaces to the percentage of maximum density for each area classification.

E. Pavement Base: Place on prepared subgrade in layers of uniform thickness conforming to indicated cross-section and thickness.

3.07 MAINTENANCE:

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS:

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

3. 09 GEOTEXTILES:

A. Install as shown on the Drawings in accordance with manufacturer’s recommendations.

* END OF SECTION 02200 *