SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Excavating and backfilling trenches for storm pipe system.
   2. Excavating and backfilling metering pit.
   3. Preparing subgrades for pavements.
   4.

B. Related Sections include the following:
   1. Division 2 Section “Excavation Support and Protection.”
   2. Division 2 Section “Pavement Resurfacing.”

1.03 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. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Stone Filling: Well graded stone to be placed as a protective material at the end of culverts or on streambanks.

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

F. Excavation: Removal of material encountered above subgrade elevations.
   1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk or Mass 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 Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

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

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbf breakout force; measured according to SAE J-732.

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

J. 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.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, or topsoil materials.

L. Topsoil shall be fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth.

M. Utilities include on-site underground pipes, conduits, ducts, and cables.

N. Trenching: Excavation in earth and rock utilizing a tracked hydraulic excavator.

1.04 SUBMITTALS

A. Product Data: For the following:
1. Each type of plastic warning tape.

B. Samples: For the following:
1. 30-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following (Contractor to pay for tests and reports):
   1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
   2. Field reports; inplace soil density tests.
   3. One optimum moisture-maximum density curve for each type of soil encountered.
   4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

D. Blasting plan approved by authorities having jurisdiction, for record purposes.

E. Seismic survey agency report, for record purposes.

1.05 QUALITY ASSURANCE

A. Comply with applicable requirements of NFPA 495, "Explosive Materials Code."

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring services during blasting operations.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials testing and inspection service during earthwork operations.

D. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to the Engineer’s satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the work.

E. Application for Blasting (Excavation) Permit: The Contractor and/or his licensed blaster will apply for a Blasting Permit and pay for any fees from the regulatory agency or departments as required.

F. Codes and Standards: The Contractor shall be responsible at all times for carrying out of all excavation operations in a safe and prudent manner so that the workers, the public, and adjacent public and private property will be protected from unreasonable hazard. Details and requirements of this protection shall conform to Title 29 Code of

Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA) and §107-05 Safety and Health Requirements Paragraph F and §107-08 Preservation of Property. All applicable local, State and/or Federal requirements shall be observed and necessary permits acquired by the Contractor.

If no support or protective system is shown in the plans or proposal, the Contractor may open the excavation with the sides sloped to a stable slope not steeper than that allowed by the Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA). Taking this option, however, does not relieve the Contractor of responsibilities as stated in this subsection. When the Contractor chooses this option, the materials used and method of construction outside the payment lines shall be in accordance with the requirements of this Section.

G. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.06 PROJECT CONDITIONS

A. Site Information: Test hole operations were performed by the Owner. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Data are made available for convenience of Contractor. 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.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

C. 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

2.01 MATERIALS

A. Tests and Control Methods. Materials, tests and control methods pertaining to the item requirements and work of this Section will be performed in conformance with the procedures contained in appropriate NYSDOT publications in effect on the date of the

advertisement for bids. These publications are available upon request to the Regional Director or the Director, Soil Mechanics Bureau.

B. Ordinary Fill: Well graded, natural inorganic soil approved by the Engineer and meeting the following requirements:

1. Free of organic or other weak or compressible materials, of frozen materials, and of stones larger than 6 inches maximum dimension.
2. Of such nature and character that it can be compacted to the specified density in a reasonable length of time.
3. Free of highly plastic clays, of all materials subject to decay, decomposition of dissolution, and of cinders or other materials which will corrode piping or other metal.
4. Maximum dry density of not less than 100 pounds per cubic foot.

NOTE: Material from excavation on the site may be used as ordinary fill if it meets the above requirements.

Restrictions: No fills shall contain brush, roots, sod, rubbish or other perishable materials. All material shall be approved by the Engineer, and if it is rejected, shall be removed at the Contractor's expense.

C. Select Materials and Subgrade Area Material Requirements. The requirements for select materials and subgrade area materials are described below. The procedure for acceptance or rejection of these materials shall be as described in the appropriate Soil Control Procedure (SCP) manual.

1. Item 4 Gravel: Material shall conform to the requirements of the NYSDOT Standard Specification, Section 304 - Subbase Course, Gradation Type 4 and shall conform to the following gradation limits:

Sieve Size	Percent Finer By Weight
2 Inch	100
¼ Inch	30 to 65
No. 40	5 to 40
No. 200	0 to 10

2. Select Granular Fill: Select granular fill shall be gravel, sandy gravel, or gravelly sand free from organic, frozen or other deleterious material conforming to the requirements of the NYSDOT Standard Specification, Section 203, meeting the following gradation limits:

Sieve Size	Percent Finer By Weight

4 Inch	100
No. 40	0 to 70
No. 200	0 to 15

3. Stone Filling: Stone filling shall consist of well graded stone placed as a protective material on streambanks as shown on the drawings.

   a. Gradation shall meet the following requirements and Section 620-2.02 of NYS Standard Specifications:

Stone Size	Percent of Total by Weight
Heavier than 100 lbs.	50 – 100
Smaller than 4 in.	0 - 10

NOTES:

1. Materials shall contain less than 20% of stones with a ratio of medium to minimum dimension greater than three.

2. Materials shall contain a sufficient amount of stones smaller than the average size to fill the spaces between the larger stones.

D. "K-Crete" Concrete

1. K-Crete shall be used as required by the Engineer, at each joint in the newly installed pipe where the required minimum horizontal and vertical separation between a water main and a storm or sanitary sewers cannot be maintained.
2. K-Crete can be supplied and installed dry or wet depending on the field conditions and installation methods.
   a. Dry K-Crete:

      1) Dry K-Crete is essentially a cement stabilized sand mixture with the following proportions:

Material	Weight (lbs)
Cement	210
Fly Ash	300
Sand	2,490

      2) Install completely around pipe joints and extend compacted 6@ thick layer along pipe 2 feet in each direction. If naturally occurring moisture to hydrate the cement is not available in the subsurface, add water after compaction as necessary to hydrate cement.

   b. Wet K-Crete or flowable fill is lightweight concrete aggregate and shall have a specification corresponding to the following:

Concrete Class:	Pipe Backfill
W/C Ratio:	2.07
Slump:	8-10"

Fine Agg. No.		8-154F SP.GR:2.65
Coarse Agg. No.:		8-9R SP GR: 2.81
Per Cubic Yard	SSD WT	SOL. VOL.
Water	465	7.45
Cement	225	1.145
Air @ 6%		1.62
Fine Agg. (Corr Sand = 85%)	2359	14.226
#1 Stone (Split = 100%)	441	2.517
#2 Stone	0	0
	3490	27.00 Ft^3

Unit Wt.: 129.27 PCF

Design Strength: 400 PSI

3. K-Crete shall be used as backfill in trenches, as required by the Ulster County Department of Public Works, under all paved surfaces.

E. Select Backfill: Run-of-Bank gravel with coarse aggregate not exceeding 1" in diameter, approved by the Engineer, shall be used as select backfill. Select backfill shall only be used to make up deficiencies in approved trench excavation.

F. Provide new topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.
   1. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes.
   2. Topsoil shall be placed to a minimum depth of six (6) inches.

G. Water: Water used for dust control or compaction purposes may be obtained from any source. When used for watering seeded or sodded areas, or surfaces to be seeded or sodded, water shall be free from oil, have a pH not less than 6.0 nor greater than 8.0 and shall be free from impurities injurious to vegetation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Establish required lines, levels, contours and datum.

B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.

C. Establish location and extent of utilities before commencement of excavation.

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

E. 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.

3.02 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.

C. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or run-off areas.

3.03 USE OF EXPLOSIVES

A. General. The Contractor shall perform all work in the contract in a workmanlike manner with due regard to the safety and health of the employees and of the public.

The Contractor shall comply with Title 29 Code of Federal Regulations Part 1926, Safety and Health Regulations for Construction (OSHA) regarding the safety and protection of persons employed in construction and demolition work.

The Contractor shall obtain a Town of Marbletown Blasting Permit prior to commencing any blasting activities. All blasting work shall be performed in accordance with the Town of Marbletown Blasting Permit.

B. Drilling and Blasting. A project meeting relative to the method, manner and procedure of blasting operations shall be held at the site with the Engineer, the Contractor, the project blaster and representatives of all interested agencies, prior to the commencement of drilling and blasting operations.

The Blasting Contractor will discuss maximum explosive charge per delay, drill hole diameter, sequenced delays and, if necessary, the decking of individual holes; he will utilize these controls to minimize blast induced vibrations. The Contractor's drilling and blasting methods must be approved prior to the commencement of drilling and blasting operations.

Prior to the commencement of drilling and blasting the Contractor will conduct a pre-blast survey.

Whenever explosives are used, they shall be of such character and strength and in such amounts as is permitted by the State and local laws and ordinances and all respective agencies having jurisdiction over them. In special cases the right is reserved for the Engineer and those agencies to specify the maximum size of the charges.

Blasting shall be done only at such time as the Engineer and those agencies shall approve and under such restrictions as they may impose.

The blasting contractor will provide vibration monitoring devices and field monitoring to insure that blasting meets project criteria.

The Contractor shall employ only experienced supervisors and workmen in the handling, loading and firing of the explosives. The Contractor's attention is directed to the requirements of Industrial Code Rule 39 of the State of New York, Department of Labor, Board of Standards and Appeals, and the applicable Sections of the Labor Law which, together with the conditions indicated herein shall provide for the possession, handling, storage and transportation of all explosives used at the site.

C. Explosives in Demolition. Demolition work shall not be performed by the use of explosives unless approved by the Engineer.

D. Excavation or Blasting Near Combustible Gas Pipes.

1. No person shall discharge explosives in the ground, nor shall any person other than state, county, city, town or village employee regularly engaged in the maintenance and repair thereof excavate in any existing street, highway or public place, unless notice thereof in writing shall have been given at least seventy-two hours in advance to the person, corporation or municipality engaged in the distribution of gas, electricity, steam or water, or the provision of telephone or telegraph service in such territory. The person having direction or control of such work shall give notice and further he shall ascertain whether there is within one hundred feet in such street, highway or public place, or in the case of a proposed discharge of explosives, within a radius of two hundred feet of such discharge, any pipe or any other person, corporation or municipality conveying combustible gas, and if there be any such pipe he shall also give such notice to any such other person, corporation or municipality. Provided, however, that in any emergency involving danger to life, health or property it shall be lawful to excavate without using explosives if the notices prescribed herein are given as soon as reasonably possible, and to discharge explosives to protect a person or persons from an immediate and substantial danger of death or serious personal injury if such notices are given before any such discharge is undertaken. Any such work shall be performed in such a manner as to avoid damage to any utility facilities.

2. If in the course of any such excavation, blasting or other work, damage or the potential thereof is occasioned to any utility facility used in the transmission or distribution of gas, electricity, water, steam, telephone, or telegraph, whether by direct contact, undermining of soil or other support thereof, or otherwise, the person having direction or control of such work shall promptly take all reasonable measures necessary to protect individuals and the public from loss or the potential thereof and shall immediately notify the person, corporation or municipality owning or operating such utility of such damage or potential damage to its facilities. Neglect on the part of the person having direction or control of such works, responsible for any damage or potential damage to such facilities (a) to take such safety precautionary measures as are necessary or reasonably required promptly or (b) to immediately notify the Owner or operator of the utility facility involved or damage or potential damage to its facilities, occasioned by such person or under his direction or control, shall be a violation of this section and constitute a misdemeanor. Nothing herein contained shall preclude or prevent recovery of monetary damages by the Owner or operator of the utility facility involved or by any other person suffering damages from the disruption of utility services occasioned by excavation, blasting or other work in the vicinity thereof.

3.04 EXCAVATION, GENERAL

A. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for as per 1.03 B of this section.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock.
    a. Do not excavate rock until it has been classified and cross-sectioned by Engineer.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing precast concrete structures, for installing services and other construction, and for inspections.

B. Excavate subsoil in accordance with the lines and levels as shown on the Drawings and as necessary for installation of the work. The excavation lines shall be such that sufficient clearance exist for the proper execution of the work, including space for formwork and bracing.

C. Maintain the slopes of excavation in safe condition until completion of the backfilling operation, in accordance with OSHA requirements.

D. Trim the bottom of all excavation to the required levels, and leave free from loose or organic matter. Fill over excavated areas under structure bearing surfaces with concrete as specified for foundations, or other material as approved by the Engineer.

E. When the excavation has been carried to the required depth, the Contractor shall await inspection of the bearing surface by the Engineer and authorization to proceed with the work.

F. Sloping surfaces under footings and foundations, or other work where required, shall be cut in steps as indicated on the Drawings or as directed by the Engineer.

G. Any excess excavation shall be removed from the site to disposal areas at the Contractor's expense.

3.06 EXCAVATION FOR PAVEMENTS

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

3.07 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width sufficiently wide to provide ample working room and a minimum of 9 inches of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond meter pit perimeter, excavate trenches to allow installation of top of pipe below frost line.

C. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of Item 4.

D. For pipes and equipment, carry excavation six (6") inches below required elevation and backfill with Item 4 gravel. At each pipe joint, dig bell holes to relieve pipe bells of loads to insure continuous bearing of pipe bearing on bearing surface. This select material shall be installed and compacted to a height of 6" over the top of the pipe as per the drawings. The remainder of the trench shall then be backfilled with acceptable excavated material, in 6" lifts, and compacted. No extra payment will be made for bedding and backfill material. Payment for these materials shall be considered as included in the appropriate pipe item.

3.08 APPROVAL OF SUBGRADE

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer 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.

C. Proof roll subgrade 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 Engineer.

3.09 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 Engineer.
   1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

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 trees.

3.11 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, dampproofing and waterproofing.
   2. Surveying locations of underground utilities for record documents.
   3. Inspecting and testing underground utilities.
   4. Removing trash and debris.
   5. Removing temporary shoring and bracing, and sheeting.

3.13 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 storm sewer trench as shown on the drawings and as directed by the Engineer

C. Revise maximum particle size in paragraph below to suit type of pipe or conduit. Revise backfill to satisfactory soil, if applicable.

D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 6 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. Where K-Crete is required as backfill this material shall be placed as per the specifications, as shown on the drawings and as directed by the Engineer.

F. Where sheeting has been used for the excavation, and incremental removal of sheeting is not specified in the plans or proposal, sheeting shall be pulled when the trench has been backfilled to the maximum unsupported trench depth allowed by Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA).

G. Coordinate backfilling with utilities testing.

H. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

I. Place and compact final backfill of satisfactory soil material to final subgrade.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 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.

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 pavements, use Item 4 material.

3.15 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.

3.16 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 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 698:
   1. Under structures, 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.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.

3. 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.

D. If the surface of any layer becomes contaminated by mud or unsuitable materials, the contaminated soil shall be removed.

E. Fill placement shall be suspended when wet weather prevents proper operation of compaction equipment.

F. No backfilling or compaction shall take place against any cast-in-place concrete footings or slabs prior to 7 days initial concrete set, or against any cast-in-place concrete walls prior to achieving the desired design strength, f'c.

G. Heavy equipment shall not be operated within 4 feet of any structure. Heavy vibratory compactors shall not be operated within 4 feet of any structure.

H. Excavated material meeting the requirements of Selected Fill shall be spread and allowed to dry until obtaining the required moisture content prior to re-use.

3.17 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 towards the stormwater inlets to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Pavements: Plus or minus 1/2 inch.

3.18 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 6 inches or less, place materials in a single layer.
5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least as wide as existing shoulders, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage 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 comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

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. Paved and Meter Pit Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length and at all fittings.

E. 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.

3.20 RESTORATION OF UNPAVED AREAS

A. Once the Contractor has completed his fine grading, he shall provide topsoil and uniformly spread this material over the area to be seeded to a depth of 6". Topsoil shall be approved by the Engineer prior to use.

B. Once the topsoil has been placed and rolled, the Contractor shall spread Fertilizer 5-10-10 which shall be applied at a rate of 5 lbs. per thousand square feet and shall be raked into the soil. The Contractor shall then seed the area with a seed mixture comprised of 40% chewings, 30% Kentucky Blue, 20% Highland Bent, and 10% Redtop. This seed shall be applied at a rate of 10 lbs. per thousand square feet. The Contractor shall then roll, water, maintain and mow this grass until a satisfactory growth has been achieved. Any patching shall be done in accordance with these specifications.

3.21 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of Section 02150 "Erosion and Sediment Control."

B. Contractor shall be responsible for all control measures necessary to prevent damage resulting from erosion and sedimentation to on-site and off-site areas.

C. Temporary de-silting basins, or other measures shall be installed in a manner satisfactory to the Engineer and maintained in good operating condition.

D. Contractor shall provide adequate protection or complete the grading and placement of topsoil, seed or sod as specified without delay on areas that may be potential contributors to pollution of natural waterways or cause damage because of sedimentation. Where areas are seeded or sodded, the contractor shall provide required maintenance and repair until final acceptance.

E. Upon satisfactory completion of the work and establishment of all seeded or sodded areas, the Contractor shall remove all erosion control devices.

3.22 STONE FILLING

A. Stone filling shall be placed in a manner that will produce a reasonable well-graded mass of stone with smaller stone fragments filling the space between the larger ones, so as to result in the minimum practicable percentage of voids. The final section of stone filling shall be in conformance with the lines, grades, and thicknesses shown on the plans. Stone filling used for bank or channel protection shall be placed to its full course thickness in one operation, unless otherwise directed by the Engineer or specified in the special provisions, and in such a manner that the underlying material will not be displaced or worked into the layer of stone filling. Placement of stone upon finished bedding material, when used, shall be carefully controlled to avoid disruption and damage to the layer of bedding material. The stone shall be so placed and distributed that there will be no pockets of uniform size material.

3.23 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 ENGINEER; 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.

3.24 CLEAN UP

A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

3.25 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 02300