Division 02

SECTION 021000
SITE PREPARATION - CLEARING, GRUBBING, AND TOPSOIL REMOVAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to complete the work specified herein and shown on the Drawings. The work shall include, but not be limited to:
   1. Clearing and grubbing the limits shown on the Drawings of trees, tree roots, brush, and incidental debris in the limits required for construction;
   2. Chipping all cleared brush and small trees;
   3. Stripping topsoil from work areas;
   4. Transporting the topsoil to stockpiles at locations approved by the OWNER
   5. Stabilizing the topsoil stockpiles.

1.02 DEFINITIONS

A. Structures and Surface Features: Existing structures and surface features including signs, posts, fences, trees, shrubs, landscaped surface features, and other miscellaneous items.

B. Utilities: Existing gas mains, water mains, steam lines, electric lines and conduits, telephone and other communication lines and conduits, sewer pipe, cable television, other utilities, and appurtenances.

C. Clearing and Grubbing: Cutting and disposing of trees, brush, windfalls, logs, and other vegetation, and removing and disposing of roots, stumps, stubs, grubs, logs, and other timber.

D. Salvaged Topsoil: Natural loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils available from overlying portions of areas to be excavated for construction.

E. Hard Fill: Crushed concrete, block, brick and inert materials resulting from demolition. Hard fill does not include wood, gypsum wall board, or putrescible material of any type.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to be cleared and grubbed include trees, roots, shrubs, and any debris or other foreign matter that is neither topsoil nor suitable for backfill, as determined by the Engineer.

B. Topsoil shall be that of surface material consisting of organic soils that typically occurs at the site to a depth of approximately 4 inches beneath ground surface.

PART 3 EXECUTION

3.01 PREPARATION

A. Provide three (3) working days notice to owners of existing utilities, structures, and surface features prior to beginning construction.

B. Provide protection and support during construction for existing utilities, structures, and surface features.

C. Remove obstructions such as mounds of dirt, stone or debris located within limits of construction. Obstructions such as culverts, end walls, signs, fencing, etc., may be removed if replaced when need for removal is completed. Replace to original condition.

3.02 CLEARING AND GRUBBING

A. Clearing and grubbing shall only be performed in areas identified within the limits of disturbance on the Drawings and as directed and approved by the OWNER. Appropriate erosion and sedimentation controls shall be in place before the start of clearing, as described in Section 029250 and 029310.

B. Do not remove or cut down trees unless located within limits of excavation as indicated on Drawings. Obtain ENGINEER's approval for all shrubs and trees to be removed.

C. Do not trim trees unless located within easements or rights-of-way shown on Drawings. Cut interfering tree roots and branches 1 in. or greater in diameter perpendicular to direction of growth on tree side of trench.

D. If weather conditions are unsuitable for clearing and grubbing, as determined by the OWNER, CONTRACTOR shall cease operations until permission to resume operations is obtained from the OWNER.

E. The CONTRACTOR shall clear and maintain all areas required for access to and execution of work.

F. Grubbing shall consist of the removal and disposal of stumps, roots, and debris from the work area(s) as shown on the Drawings. The CONTRACTOR shall remove grubbed material from the site. Dispose of materials removed by clearing and grubbing in accordance with applicable Local, State and Federal regulations.

G. The CONTRACTOR shall protect all existing structures and all utilities which are to remain. CONTRACTOR shall be liable for any and all damages caused by clearing and grubbing operations.

3.03 TOPSOIL REMOVAL

A. Topsoil may be removed from the areas within the limits of disturbance as indicated on the Drawings upon request by the CONTRACTOR and approval by the Engineer. The depth of topsoil removal shall be determined by CONTRACTOR conducted testing and evaluation of the soils encountered and approved by the Engineer.

B. Before stripping or removing topsoil, the CONTRACTOR shall mow or otherwise remove all heavy grass, weeds, or other vegetation over areas from which topsoil is to be removed. The Engineer shall determine whether excessive vegetation is present prior to any stripping operations. Appropriate erosion and sedimentation controls shall be in place before the start of topsoil removal, as described in Section 029250 and 029310.

C. Equipment and methods of operation employed shall be chosen with the intent of avoiding lifting subsoil or other unsuitable material.

D. Strip stockpile areas of vegetation prior to stockpiling.

E. Stripped topsoil shall be free from clay, stones, vegetation, and debris.

3.04 TOPSOIL STOCKPILING

A. The CONTRACTOR shall keep topsoil separate from other excavated materials. Topsoil shall be completely removed to the required depth from the designated area before beginning excavation or fill placement work in the area. Topsoil shall not be removed to a depth greater than directed by the Engineer.

B. Topsoil shall be stockpiled on well drained land in an area identified by CONTRACTOR and acceptable to the OWNER. Topsoil shall be placed in stockpiles of neat conformations and having side slopes no steeper than 4H:1V. The surface of each topsoil stockpile shall be shaped and tracked at the end of each working day.

C. The topsoil stockpiles shall be isolated by surrounding them with silt fence.

3.06 EXCESS MATERIAL

A. The CONTRACTOR shall at the CONTRACTOR’s expense:

1. Stockpile excavated material suitable for backfill on site.
2. Place material as ordered by ENGINEER on-site.
3. Remove material not required by OWNER from the Site and provide for proper disposal meeting all Local, State, and Federal regulations.

END OF SECTION

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SECTION 021105
CARE AND PROTECTION OF PROPERTY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protection of Property
B. Work within Highway Right-of-Way
C. Notice to Property Owner

1.02 PROTECTION OF PROPERTY

A. Do not enter or occupy with workers, tools, materials or equipment any land other than the right-of-way and easements without the written consent from the property owner.
   1. File a copy of the written consent with the ENGINEER.
   2. Assume full responsibility for the use of said private properties and defend the OWNER against all claims for damages from use of same.
B. Provide and maintain all necessary watchman, barricades, lights and warning signs and take all necessary precautions for the protection and safety of the public, the OWNER, the ENGINEER and property.
C. Continuously maintain adequate protection to all Work from damage, and take all reasonable precautions to protect the Public's and the OWNER's property from injury or loss arising in connection with this Contract.
D. Make good any damage, injury or loss to the work and to the property of the OWNER and the Public resulting from lack of reasonable protective precautions, except as may be due to errors in the Contract Documents, or caused by the agents or employees of the OWNER.
E. In an emergency affecting the safety of life, the work, or adjoining property, the CONTRACTOR is, without special instructions or authorization from the ENGINEER, hereby permitted to act at his sole discretion to prevent such threatened loss or injury. He shall also act, without appeal, if so authorized or instructed by the ENGINEER.
F. Any compensation claimed on account of emergency work, to protect the public, the work, or adjoining property, will be determined by agreement or by arbitration.
G. Exercise extreme care to prevent damage to trees, flowers, shrubs, etc. Bear all costs of replacing or repairing trees, shrubs, flowers, etc.
H. Replace or re-erect all fences and guard rails taken down or disturbed to the satisfaction of the ENGINEER, at no additional cost to OWNER.
I. Conduct work in a manner to properly protect all other utility facilities, such as gas mains, telephone and power conduits and poles, sewers, drainage, cable, fiber optics and other similar facilities. Work near these facilities in accordance with the utility's requirements, rules and regulations. If any utility is damaged, immediately notify the utility involved so that proper inspection and repair can be made.
J. The OWNER or ENGINEER will attempt to notify the CONTRACTOR of any hazardous condition during non-working hours by telephone. If the OWNER or ENGINEER is unable to reach the CONTRACTOR or the CONTRACTOR fails to correct the hazardous condition utilizing all necessary safety devices within one (1) hour after notification, the OWNER will make all necessary repairs at the expense of the CONTRACTOR. If the hazardous condition is of such a nature, in the opinion of

the ENGINEER, that it should be remedied immediately and the CONTRACTOR is unable or refuses to do so, the OWNER will make all necessary repairs at the expense of the CONTRACTOR.

1.03 NOTICE TO PROPERTY OWNERS

A. Notify property owners at least one (1) week advance of pending construction. Keep driveways open and in good conditions at all times.

1.04 WORK WITHIN HIGHWAY RIGHTS-OF-WAY

A. Perform and complete all work in State, County and Town rights-of-ways to the full satisfaction of the various Departments of Public Works concerned. Obtain all permits required.
B. Conduct operations associated with the Work so as not to interfere with the movement of traffic on highways and with the operations of the particular Department of Public Works.
C. If at any time during the work, traffic or facilities of the State of New York, County, Village or Town are endangered, immediately do such work as the representative of the particular Department of Public Works concerned may direct to restore safety. Bear all expenses of restoring safety based on the directions of the particular Department of Public Works representative, at no additional cost to the OWNER.
D. Permit inspection by the State of New York, County, Village or Town at all times as the work progresses.
E. Give written notice to the Sate of New York, County, Village or the Town five (5) days before work begins within their right-of-way.

1.05 WORK WITHIN WETLANDS AND WETLAND BUFFER ZONES

A. The OWNER will obtain all necessary permits for working within wetlands and wetland buffer zones.
B. The CONTRACTOR shall adhere to all of the requirements of the permits.
C. No refueling, oiling, or greasing of construction equipment is allowed in the Wetland or New York State Wetland Buffer Zone.
E. In the event of spillage of petroleum products within the Wetlands or Wetlands Buffer Zone, take prompt remedial action to stop, contain and remove any spilled materials.
F. Remove excess spoils, in their entirety, off-site in an amount proportionate to the volume of the pipe and any bedding material installed. Maintain the original bottom contour surface elevations.

END OF SECTION

SECTION 021560
PROTECTION OF THE ENVIRONMENT

PART 1 GENERAL

1.01 SUMMARY

A. CONTRACTOR, in executing Work, shall maintain Work areas on- and off-site free from environmental pollution that would be in violation of federal, state or local regulations.

B. CONTRACTOR is required to sign and submit ENGINEER's SWPPP to the OWNER and ENGINEER to file, when applicable.

1.02 PROTECTION OF STORM SEWERS

A. Prevent construction material, pavement, concrete, earth or other debris from entering existing storm sewer or sewer structure.

1.03 PROTECTION OF WATERWAYS

A. Observe rules and regulations of the State of New York and agencies of U.S. government prohibiting pollution of lakes, streams, rivers or wetlands by dumping of refuse, rubbish, dredge material or debris.

B. Disposal of materials into waters of state must conform to requirements of the State of New York and the U.S. Army Corps of Engineers. All permits will be obtained by CONTRACTOR, copies provided to the ENGINEER, and posted on the job site.

C. Apply appropriate soil conservation measures to protect project area and adjacent lands. These measures may include, but not be limited to, mulching, rapid growth vegetation, fabric mat, filter barriers, sediment traps, and basins.

D. All work for this section shall be performed in strict accordance with "New York State Standards and Specifications for Erosion and Sediment Control", NYSDEC, latest edition, (i.e., Standards). The Standards are incorporated herein by reference.

E. Prepare and submit the following to ENGINEER:
1. Limits of disturbance.
2. Sequence of construction as it relates to installation, phasing, and removal of sediment control measures.

F. Provide erosion control measures, in place, before commencing work on project site.
1. Maintain erosion control measure during course of construction.
2. Remove erosion control measures upon establishment of permanent, surface stabilization.

G. Complete temporary or permanent stabilization of surface of perimeter controls, dikes, swales, ditches, perimeter slopes, and slopes greater than 3:1 within 7 calendar days following initial soil disturbance. Stabilize other disturbed or graded areas within 14 calendar days.

1.04 DISPOSAL OF EXCESS EXCAVATED AND OTHER WASTE MATERIALS

A. Excess excavated material not required or suitable not for backfill and other waste material shall be disposed of in accordance with State and local regulatory requirements.

B. Provide watertight conveyance for liquid, semi-liquid or saturated solids which tend to bleed during transport. Liquid loss from transported materials is not permitted, whether being delivered to construction site or hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at selected disposal site.

1.05 PROTECTION OF AIR QUALITY

A. Minimize air pollution by requiring use of properly operating combustion emission control devices on construction vehicles and equipment and encourage shutdown of motorized equipment not in use.

B. Do not burn trash on construction site.

C. If temporary heating devices are necessary for protection of Work, they shall not cause air pollution.

1.06 THAWING OF FROZEN GROUND

A. Obtain permit from appropriate local authority before building fire to thaw frozen ground, and comply with conditions of permit.

B. Use fuel which does not create air pollution or inconvenience public.

C. ENGINEER reserves right to prohibit fires for thawing whenever deemed undesirable.

1.07 USE OF CHEMICALS

A. Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall be approved by U.S. EPA or U.S. Department of Agriculture or any other applicable regulatory agency.

B. Use and disposal of chemicals and residues shall comply manufacturer's instructions.

1.08 NOISE CONTROL

A. Conduct operations to cause least annoyance to residents in vicinity of Work, and comply with applicable local ordinances.

B. Equip compressors, hoists, and other apparatus with mechanical devices necessary to minimize noise and dust. Equip compressors with silencers on intake lines.

C. Equip gasoline or oil-operated equipment with silencers or mufflers on intake and exhaust lines.

D. Line storage bins and hoppers with material that will deaden sounds.

E. Conduct operation of dumping rock and of carrying rock away in trucks so as to cause minimum of noise and dust.

F. Route vehicles carrying rock, concrete or other material over such streets as will cause least annoyance to public and do not operate on public streets between hours of 6:00 p.m. and 7:00 a.m., or on Saturdays, Sundays or legal holidays unless approved by ENGINEER.

1.09 DUST CONTROL

A. Due to close geographic location of Project to other off-site facilities and residential homes**,** take special care in providing and maintaining temporary site roadways, OWNER'S existing roads, and public roads used during construction operations in clean, dust free condition.

B. Comply with state and local environmental regulations for dust control. If CONTRACTOR'S dust control measures are considered inadequate by ENGINEER, ENGINEER may require CONTRACTOR to take additional dust control measures.

C. The use of calcium chloride is prohibited.

1.10 FUELS AND LUBRICANTS

A. Comply with local, state and federal regulations concerning transportation and storage of fuels and lubricants.

B. Fuel storage area and fuel equipment shall be approved by OWNER prior to installation. Submit containment provisions to OWNER for approval.

C. Keep motorized equipment in good working order with no fuel or lubricant leakage. In the event of a leak, protect ground surface from leakage using tarps or other methods, and immediately remove leaking equipment or make repairs. Report spills or leaks from fueling equipment or construction equipment to OWNER and cleanup as required.

D. OWNER may require CONTRACTOR to remove damaged or leaking equipment from Project site.

E. Refueling, lubrication, and any other maintenance of equipment shall not be performed in or near any streams or wetland areas. Maintenance tasks shall be conducted at an upland staging area at least 100 feet away from any waters or wetlands. The CONTRACTOR shall have spill-kits on site at all times.

PART 2 PRODUCTS
2.01 (Not Used)

PART 3 EXECUTION
3.01 (Not Used)

END OF SECTION

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SECTION 021570
MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 GENERAL

1.01 SUMMARY

A. Work shall consist of maintaining traffic and protecting the public from damage to person and property within the limits of and for the duration of the contract.

B. Town Hall Way will be open to through traffic during construction. Contractor is responsible for keeping the road clear and free of debris and equipment.

1.02 REFERENCES

A. "Standard Specifications, Construction and Materials," New York State Dept. of Transportation, most current publication.

1.03 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Traffic shall be maintained over a reasonably smooth traveled way which shall be so marked by signs, delineators, guiding devices and other methods that a person who has no knowledge of conditions may safely and with a minimum of discomfort and inconvenience ride, drive, or walk, over all or any portion of the roadway and sidewalk under construction where traffic is to be maintained.

B. All traffic control methods devices shall meet the requirements of NYSDOT Section 619 of "Standard Specifications," which include, but are not limited to the following:

1. Surface:
   Maintain the surface condition of the traveled way so it is consistent with the appropriate speed limit.
2. Drainage:
   Maintain the drainage facilities and other highway elements, old or new, including that on detours
3. Dust Control, sediment and Spillage:
   Control dust and keep roadways free from materials spilled from hauling equipment. Use a street sweeper on Town Hall Way when ordered by Engineer.

C. CONTRACTOR shall coordinate road closure with the Owner.

PART 2 PRODUCTS

(Section not used)

PART 3 EXECUTION

3.01 CONSTRUCTION SIGNS

A. The CONTRACTOR shall furnish, install, move and maintain Construction Signs in accordance with the requirements of NYSDOT Section 619 of "Standard Specifications".

3.02 CONSTRUCTION VECHILES AND EQUIPMENT

A. All construction vehicles and equipment shall meet the requirements of NYSDOT Section 105-12 *Load Restrictions* of "Standard Specifications."

END OF SECTION

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SECTION 022000
EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

Section Includes
A. Excavating
B. Preparing Subgrade for Fill, Foundations, Pavement
C. Placing and Compacting Soil and Aggregate Fill, Drainage Course, Subbase, Base
D. Backfilling at Structures, Utilities and Appurtenances
E. Grading

1.02 Related Sections
A. 021000 Site Preparation
B. 029250 Soil Erosion and Sediment Control
C. 022210 Trenching and Excavation
D. 022240 Rock Excavation
E. 026100 Pipeline Installation
F. 029500 Dewatering
G. 033000 Cast In Place Concrete

1.03 REFERENCES

ASTM (American Society for Testing and Materials)
A. D 422 Particle Size Analysis for Soils
B. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort D 1241 Specification for Soil-Aggregate Subbase, Base and Surface Courses
C. D 2216 Moisture Content of Soil and Rock
D. D 2487 Classification of Soils for Engineering Purposes
E. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods
F. D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports
G. D 3017 Water Content of Soil and Rock In Place by Nuclear Methods
H. E 1643 Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
I. OSHA (Occupational Safety and Health Administration) , 29 CFR Part 1926

1.04 DEFINITIONS

A. *Additional Excavation* is the removal and disposal of material encountered below the Subgrade elevation indicated on the Drawings as authorized in writing by the Engineer.

B. *Excavation* is the removal and disposal of material encountered above the Subgrade elevation indicated on the Drawings. Excavation also includes removal and disposal of hard, compacted or cemented material down to eight inches below the Subgrade Elevation indicated on the Drawings if required in the judgment of the Engineer. The removal and disposal of hard, compacted or cemented material will be considered rock excavation if the material is rock as defined in section 022240 and this section.

C. *Fill* is Soil and Aggregate Material placed according to these Specifications to raise the subgrade elevation to the elevation indicated on the Drawings.

D. *Maximum Density* is the maximum dry density determined by ASTM D 698.

E. *Optimum Moisture Content* is the moisture content that corresponds to the Maximum Density.

F. Rock is all hard, compacted or cemented material that in the judgment of the Engineer requires blasting or cannot be ripped using a Cat 330 with a heavy-duty, single-tooth ripping attachment.

G. *Structure* is any building, foundation, slab, curb, utility or appurtenance permanently installed above or below the ground surface.

H. *Subgrade* is the undisturbed earth or compacted fill immediately below the drainage course, subbase, or topsoil.

I. *Unauthorized Excavation* is the removal or disposal of any material other than Excavation or Additional Excavation.

J. *Unsuitable* is material that does not comply with these specifications.

1.05 SUBMITTALS

A. Test Reports
   1. Classification of Soil and Aggregate Materials for each specified purpose
   2. Compaction Characteristics of Soil and Aggregate Materials for use as Fill
   3. In Place Density Determinations for Fill

B. Project Record Documents
   1. Plan drawing of final Subgrade and buried Structure elevations

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Subject to Engineer approval

B. Regulatory Requirements
   1. Notify potential owners of Underground Utilities of Excavation Schedule at least three days prior to initial Earthwork or earlier if required by law.
   2. Perform all Excavation in accordance with Department of Labor, Occupational Health and Safety Administration Standards for Excavation - 29 CFR 1926

C. Pre-Installation Conference
   1. Coordinate with the Engineer at least one week prior to the initial Earthwork to confirm the receipt of Material samples and to present a schedule of Earthwork.

1.07 PROJECT/SITE CONDITIONS

A. Environmental Requirements
   1. Perform Earthwork only when air temperature is above 28°F.
   2. Perform Earthwork only when moisture conditions allow compliance with these specifications and do not promote deterioration of Subgrade or completed Work.
   3. Perform Earthwork only during the hours from sunrise to sunset except as otherwise specified in writing by the Engineer
   4. Perform Earthwork only when wind conditions do not cause Soil or Aggregate dust to leave

the site of the Work.

B. Existing Conditions
   1. Review the geotechnical exploration of the site.
   2. Promptly and before such conditions are disturbed, notify the Owner in writing of subsurface or latent physical conditions at the site differing from those indicated in this contract, or unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent work of the character provided for in this contract. The Owner shall investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the contractor's cost of, or the time required for, performance of any of the work under this contract, whether or not as a result of those conditions, an equitable adjustment shall be made and the contract modified in writing accordingly. No claim of the contractor under this clause shall be allowed unless the contractor has given the notice required above. No claim by the contractor for an equitable adjustment shall be allowed if ascertained after final payment under this contract.

C. Field Measurements
   1. Survey cross-sections prior to and following the completion of Work Items to compute any rock excavation quantities. (Load counts, Weight tickets or other material quantity estimates not based on surveyed cross sections will not be accepted as evidence of rock excavation quantities.) Survey cross-sections for general excavation shall be submitted for records, however, the quantity of these excavations are included as a lump sum item and will not affect the Contract Price.

PART 2 PRODUCTS

2.01 MATERIALS

B. Provide Soil and Aggregate Materials as defined in Section 022210

2.02 EQUIPMENT

A. Provide operable Compaction Equipment (for areas 15 feet or more wide) prior to the initial Earthwork:

   1. of the vibratory smooth steel drum type (for GW or SW soils) or the vibratory steel pad foot drum type (for GP, GM, SP or SM) or the sheeps foot or wobble wheel type for (CL, ML, CH, MH, GC, or SC soils) manufactured for the purpose of compacting soil and aggregate of the characteristics of the Soil or Aggregate being used
   2. of static weight of at least twenty five tons
   3. capable of achieving the specified densities within six passes

B. Provide operable Compaction Equipment (for areas less than 15 feet wide including utility trenches and structure backfill zones) at times when adjacent wider zones of fill are being compacted so that the narrow zones can be compacted simultaneously where practical. Compaction Equipment must be suitable to the Soil and Aggregate being used.

C. Provide operable Moisture Conditioning Equipment prior to the initial Earthwork that:

   1. includes a trailer or vehicle mounted tank and spray arm
   2. includes a means of delivering potable water to the site

3. includes a disc harrow, spring-tooth harrow or other equipment with similar capability to loosen and aerate soil and aggregate

2.03 SOURCE QUALITY CONTROL

A. Provide submittals and testing of every proposed soil as required in Section 022210

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavate Soil to the Subgrade Elevation indicated on the Drawings after clearing, grubbing and stripping topsoil.

B. If Rock, as defined in this Section and Section 022240 is encountered, excavate to eight inches below the Subgrade Elevation indicated on the Drawings.

3.02 PREPARATION FOR STRUCTURES AND FILL

A. Protect structure foundation area from disturbance by heavy equipment traffic.

B. Establish temporary surface drainage improvements in conjunction with Erosion and Sediment Control Measures so that work areas do not impound water.

C. Proof roll subgrade after clearing, grubbing and stripping topsoil and before placing any fill using a completely loaded dump truck, or a fully ballasted rubber tired proof roller weighing at least 25 tons.

D. Proof roll in two perpendicular directions using two complete overlapping coverages of each part of the surface to receive a Structure or Fill.

E. Proof roll only under the observation of the Engineer or the representative designated by the Engineer.

F. Over-excavate any weak, soft or otherwise unsuitable areas that, in the sole judgment of the Engineer, do not adequately withstand proof rolling until adequate subgrade is achieved.

3.03 FILL PLACEMENT AND COMPACTION

A. Bench existing slopes steeper than one vertical to four horizontal so that nearly horizontal benches at least six inches deep at the cut side are created.

B. Scarify to a depth of at least six inches, moisture condition and recompact all existing surfaces to receive fill except as otherwise specified in writing by the Engineer.

C. Spread fill in nearly horizontal lifts no more than eight inches thick, loose measure (four inches maximum lift thickness for fill and backfill in confined areas to be compacted using equipment smaller than specified for areas 15 feet or more wide under section 2.02 A).

D. Moisture Condition the fill so that its actual moisture content is within two percentage points of the Optimum Moisture content.

E. Compact each lift of fill Material using at least three and as many additional complete, overlapping

coverages by the Compaction Equipment as necessary to achieve an actual dry density of at least 98 percent of the (Standard Proctor) Maximum Dry Density.

F. Operate Compaction Equipment at a speed no greater than a slow walk and otherwise in accordance with the manufacturers' recommendations for the characteristics of the Soil or Aggregate being used.

G. Cooperate with the Engineer as he observes the compaction process and performs in place density tests to measure the in place density of each compacted lift at a frequency of approximately one test per 2,000 square feet of surface area.

H. Scarify, moisture condition and recompact any zone of any lift that does not exhibit a density at least equal to that specified.

I. Place succeeding lifts, following these Specifications, only after the entire lift exhibits at least the specified density.

J. Remove and replace or scarify, moisture condition and recompact all fill which experiences saturation, desiccation, freezing or deterioration due to traffic.

K. Use alternative material or placement and compaction procedures if the fill is unstable, weaves under the tires or tracks of construction equipment or exhibits characteristics that would reasonably be expected to cause poor performance of the fill or supported structures.

3.04 GRADING

A. Place Fill to at least the elevation indicated on the Drawings.

B. Trim all cut and compacted surfaces to within 0.05 feet of the elevation indicated on the Drawings.

3.05 BACKFILL

A. Place Soil and Aggregate Materials for Backfill in lifts no less than three inches thick and no more than six inches thick, loose measure.

B. Place backfill on both sides of footings, buried walls and utilities so that there is no more than an eight inch difference in fill height on opposite sides of the structure.

C. Place backfill simultaneously with adjacent fill where practical to do so.

D. Use Compaction Equipment specified for areas less than 15 feet wide to compact backfill within six feet of structures.

3.06 DRAINAGE COURSE, SUBBASE, BASE

A. Place Soil and Aggregate Materials for Drainage Course, Subbase and Base in lifts no less than three inches thick and no more than six inches thick, loose measure.
B. Compact Soil and Aggregate Materials for Drainage Course, Subbase and Base using six complete, overlapping passes of the Compaction Equipment specified for the width of the zone being compacted.

C. Thoroughly moisten but do not saturate Base Material to receive Portland cement concrete footings,

slabs and pavement immediately prior to concrete placement. Wherever a vapor barrier is used follow the requirements of the manufactures or at a minimum ASTM E 1643 for placement, protection, and repair of the vapor retarder (as needed).

D. Notify the Engineer at least 24 hours prior to the placement of any concrete footings or slabs and obtain his acknowledgment that the surface is prepared to receive concrete.

3.07 COHESIVE FILL

A. Place Soil Materials for Cohesive Fill in lifts no less than three inches thick and no more than six inches thick, loose measure. Place backfill on both sides of footings, buried walls and utilities so that there is no more than an eight inch difference in fill height on opposite sides of the structure

B. Place Soil Materials for Cohesive Fill around storm water management facilities in lifts no greater than six inches loose measure.

C. Compact each lift of Cohesive Fill Material using at least three and as many additional complete, overlapping coverages by the Compaction Equipment as necessary to achieve an actual dry density of at least 90 percent of the (Standard Proctor) Maximum Dry Density.

3.08 FIELD QUALITY CONTROL

A. Control quality of Work in progress and completed Work.

B. Contractor shall provide independent observation and testing services.

C. Cooperate with independent observation and testing services.

3.09 PROTECTION

A. Protect stockpiles from saturation by grading stockpile surfaces to drain and rolling those surfaces with a smooth drum roller, by covering stockpiles with plastic sheeting or other measures adequate to maintain the stockpiled material in a condition suitable for the intended use.

B. Protect fills in progress from saturation by maintaining a positive slope on the fill surface and by rolling the fill surface with a smooth drum roller at the end of each day of operation and whenever precipitation is predicted.

C. Protect footing Subgrade from saturation and physical disturbance by placing a lean concrete mudmat if adverse weather conditions are likely to occur. Note that this measure may not protect Subgrade from deterioration due to freezing.

END OF SECTION

SECTION 022210
TRENCHING & EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment to perform all trenching and excavation as well as backfill placement and compaction as specified herein and as shown on the Drawings. Work of this section includes, but is not necessarily limited to:

1. Trenching for the installation of sewer and water lines
2. Trenching for the installation of sewer force main
3. Trenching for the installation of culverts
4. Trenching for the installation of electrical and instrumentation conduit
5. Excavation for the installation of all cast-in-place and pre-cast structures
6. Excavation of unsuitable material

B. The CONTRACTOR shall also furnish all labor, materials, tools, supervision, transportation, and installation equipment for sheeting, shoring, and bracing, dewatering, maintenance of existing utilities, providing temporary water service, disposal of excess materials and clean up of the site.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM), and “Standard Specifications, Construction and Materials”, New York State Department of Transportation, latest edition: January 2, 2002.

1.03 RELATED SECTIONS

A. 021000 Site Preparation
B. 029250 Soil Erosion and Sediment Control
C. 022200 Earthwork
D. 022240 Rock Excavation
E. 026100 Pipeline Installation
F. 029500 Dewatering
G. 033000 Cast-In-Place Concrete
H. 033500 Pre-Cast Concrete Structures

1.04 DEFINITIONS

A. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by ENGINEER.

B. Hard Material

1. Weathered rock, dense consolidated deposits, including conglomerate materials which are not included in definition of "rock" but which usually require use of heavy excavation equipment, ripper teeth or jack hammers for removal.

2. Material identified as having standard penetration resistance, as determined by ASTM D1586, between 60 and 600 blows/ft defined as "hard material".

C. Pipe Zone

1. Pipe Zone extends from the base of the trench excavation (a minimum of 6 inches below the bottom of the pipe) to a minimum elevation as shown on the Contract Drawings above the crown of the pipe.

1.05 QUALITY ASSURANCE

A. Testing:

1. Laboratory Testing

Testing shall be performed by the CONTRACTOR and at CONTRACTOR's expense by a third party soils testing laboratory approved by the ENGINEER. The CONTRACTOR shall collect and have tested (1) set of samples for each of the soil materials per the table below that summarizes testing requirements for each soil source. Testing methods are as follows:

a. Standard Proctor Moisture-Density Relationship as described by ASTM D-698
b. Sieve Analysis as described by ASTM D-422
c. Freeze Thaw Analysis as described by NYS DOT Method 208

All tests shall be performed in accordance with this specification and shall be completed prior to use on site. Results should be submitted to the ENGINEER for approval 7 days prior to commencing work. The following table summarizes the required analyses for each of the soil materials.

Table 1. Aggregates

Aggregate Type	NYS DOT Requirements	ASTM D-698	ASTM D-422	NYS DOT Method 208	Intended Use (AOBE)
Select Granular Fill (Structural Fill)	NYS DOT 203-2 (C)	**X**	**X**	**X**	Trench backfill, tank subbase, pipe bedding, general backfill
Controlled Low Strength Material (Flowable Fill)	NYS DOT 204-2			**X**	Separation between buried piping AOBE
Screened Gravel Type 4	NYS DOT 304-2 Type 4	**X**	**X**		Interior backfill below slabs
Crushed Stone # 2	NYS DOT 623.12 # 2		**X**	**X**	Drainage, pipe bedding, building and structure foundation
Crushed Stone # 1	NYS DOT 623.12 #1		**X**	**X**	Drainage, pipe bedding, building and structure foundation
Light stone fill	NYS DOT 620-2.02 - light		**visual**	**X**	Slope protection
Medium stone fill	NYS DOT 620-2.02 - medium		**visual**	**X**	Slope protection
Heavy stone fill	NYS DOT 620-2.03		**visual**	**X**	Slope protection
Subbase course Type RC-1	As described herein		**X**	**X**	Asphalt subbase beneath all local roads and driveways

Table 2. Gradation Requirements – Percentage by Weight Passing the following Square Openings

Aggregate Type	4" (100 mm)	3" (75 mm)	2-1/2" (63 mm)	2" (50 mm)	1-1/2" (37.5 mm)	1" (25 mm)	1/2" (12.5 mm)	1/4" (6.3 mm)	1/8" (3.2 mm)	No. 40 Sieve (425 µm)	No. 80 Sieve (180 µm)	No. 200 Sieve (75 µm)
Select Granular Fill	100	-	-	-	-	-	-	-	-	0-70	-	0-15
Screened Gravel Type 4	-	-	-	100	-	-	-	30-65	-	5-40	-	0-10
Crushed Stone # 2	-	-	-	-	100	90-100	0-15	-	-	-	-	0-1.0
Crushed Stone #1	-	-	-	-	-	100	90-100	0-15	-	-	-	0-1.0
Subbase Type RC-1	As described herein											

Table 3. Stone Filling Gradation Requirements

Stone Filling Item	See Notes	Stone Size[1]	Percent of Total by Weight	For Contract
Fine	2, 3, 4	Smaller than 200 mm	90 - 100	N/A
		Larger than 75 mm	50 – 100	
		Smaller than 2.0 mm	0 -10	
Light	2, 3, 4	Lighter than 50 kg	90 – 100	
		Larger than 150 mm	50 – 100	
		Smaller than 12 mm	0 – 10	
Medium	2, 4	Heavier than 50 kg	50 – 100	
		Smaller than 150 mm	0 – 10	
Heavy	2, 4, 5	Heavier than 300 kg	50 – 100	
		Smaller than 150 mm	0 – 10	

Notes:
1. Stone sizes, other than weights, refer to the average of the maximum and minimum dimensions of a stone particle as estimated by the engineer.
2. Materials shall contain less than 20 percent of stones with a ratio of maximum to minimum dimension greater than three.
3. Air-cooled blast furnace slag, cobbles, or gravel having at least one fractured face per particle are acceptable substitutes for stone under these items, provided that the soundness and gradation requirements are met.
4. Materials shall contain a sufficient amount of stone smaller than the average stone size to fill in the spaces between the larger stones.
5. Heavier gradings of this item may be required on some projects, in which case the requirements will be stated on the plans or in the proposal.

2. <u>During Construction Testing</u>

The CONTRACTOR will perform field quality assurance testing of all soil placement operations. Specifically, the CONTRACTOR will perform in place density and moisture testing using a nuclear density gauge as described by ASTM D-2922/3017. Density/moisture testing will be performed on Select Granular Fill, Subbase, Unclassified Backfill and Pipe Bedding materials at a frequency as required per this specification or as required by the ENGINEER in the field.

Additionally, the ENGINEER will perform visual inspections for gradation on the light and medium stone fills as well as for the rip rap.

Additional testing will be used at the discretion of the ENGINEER when visual observations indicate a change in the material or the construction performance. If a defective area is discovered, the ENGINEER will immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the ENGINEER will determine the extent of the defective area by additional tests, observations, a review of records, or other means that the ENGINEER deems appropriate. If the defect is related to adverse site conditions ENGINEER will define the limits of the defect and consult with the OWNER.

3. Frequency

Laboratory Analysis:

a. The CONTRACTOR shall collect and have tested (1) set of samples for each of the soil materials for each soil source.
b. Additional sampling will be used at the discretion of the ENGINEER when visual observations indicate a change in the material or the construction performance.

During Construction (Moisture/Density Testing):

a. One per 500 LF per lift for pipe bedding and select granular fill in pipe trenches
b. One per 2,000 square feet area per lift (minimum one per test area)

B. Sheeting, Shoring, and Bracing:

1. Sheeting, shoring, and bracing shall be designed by a Professional ENGINEER registered in the State of New York.
2. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state, or local public agency having jurisdiction over such matters. Most stringent of these requirements shall apply.

1.06 SUBMITTALS

A. The CONTRACTOR shall submit the following information and samples to the ENGINEER a minimum of 14 days prior to starting construction of each soil component.

1. The proposed material source.
2. Laboratory test data in conformance with the requirements of Part 2.01.
3. A 10-pound sample of the proposed stone material for the ENGINEER'S use.

B. The CONTRACTOR shall notify the ENGINEER in writing a minimum of 7 days prior to starting construction of any soil component. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, the name of the person in the field who will be in charge of this construction.

C. Shoring, Bracing, and Sheet Piling Construction Procedures and Details: If CONTRACTOR elects to use sheeting, shoring, or bracing, CONTRACTOR shall prepare a detailed shop drawing showing the sheeting, shoring, or bracing to be used. Sheeting, shoring, and bracing shall be designed and stamped by a Professional ENGINEER licensed in New York State. ENGINEER will review submitted material to ascertain effect on new construction. ENGINEER will not review shoring, bracing, and sheeting for structural integrity or effect on existing facilities.

D. Submit in accordance with Submittals Section 013300, Supplemental General Requirements

1.07 PROJECT/SITE CONDITIONS

A. Do not block or obstruct sidewalks or pavements with excavated materials, except as authorized by the ENGINEER. Trim banks to minimize inconvenience to public travel.

B. Sheeting, Bracing, and Shoring:

1. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state, or local public agency having jurisdiction over such matters. Most stringent of these requirements shall apply.
2. Sheeting, shoring, and bracing shall not affect structural integrity of new construction, water tightness or waterproofing of new construction, and shall allow for sufficient clearances necessary to install associated appurtenances adjacent to new construction.
3. When close sheeting required, drive to prevent soil from entering trench below or through such sheeting.
4. Fill voids remaining after sheeting pulled with sand or other approved material.

C. Trenching, Backfilling, and compacting within influence zone of existing or future structures shall be in accordance with this Section.

PART 2 PRODUCTS

2.01 Aggregate and fill materials used in construction shall conform with the following requirements:

A. Select Granular Fill - NYS DOT 203-2 – To be used as structural fill under structures and as pipe bedding

B. Controlled Low Strength Material (CLSM) – NYS DOT 204-2 - To be utilized at pipe crossings AOBE

C. Screened Gravel Type 4 – NYS DOT 304-2 Type 4 – To be utilized as fill under interior slabs

D. Crushed Stone # 2 – NYS DOT 623.12 # 2 – To be utilized for base underneath all structures and as pipe bedding

E. Crushed Stone # 1 – NYS DOT 623.12 # 1 - To be utilized for base underneath all structures and as pipe bedding

F. Light Stone Filling – NYS DOT 620.03

G. Medium Stone Filling – NYS DOT 620.04

H. Heavy Stone Filling – NYS DOT 620.05

I. Subbase Course – Type RC-1
Maximum particle size is 1-1/4"; Minimum particle size is 3/4". A maximum of 8% by weight shall pass the #200 size sieve. It shall be used as a subbase beneath all municipal paving as shown on the plans. Referred to as "run-of-crusher", the material shall be angular crusher run stone as delivered unsorted from the crusher. Unless stated otherwise in the Special Requirements, limestone material shall be used, and shall be well graded,

durable and composed of rock pieces, chips and fines. The amount of fine material shall be sufficient to fill all voids between large stones when the material is compacted.

J. Acceptable Earth Fill (Unclassified Earth Fill)
May be used upon approval from ENGINEER for fill in areas not under nor adjacent to structures, sidewalks or roadways: Acceptable Earth Fill may be excavated materials which are clean, consisting of earth, loam, sandy clay or other material approved by the ENGINEER in the field. Acceptable Earth Fill shall be free of large clods, pavement, broken pipe, concrete rubble or other debris, rock or boulders greater than 4" in diameter and soils containing vegetable or organic matter such as muck, peat, organic silt or any other deleterious matter.

2.02 GEOTEXTILE

A. Non-Woven shall be Mirafi 140N or equal.
B. Woven shall be Mirafi 600X or equal

2.03 SHEETING, SHORING, AND BRACING

A. Type, design, and installation of shoring, sheeting, and bracing shall be determined by and sole responsibility of CONTRACTOR.

PART 3 EXECUTION

3.01 PREPARATION

A. CONTRACTOR shall locate all existing utilities and conduct exploratory excavations AOBE to verify the location and elevations of existing utilities. Final submittals and pipe purchases shall not occur until this work is complete.

B. CONTRACTOR shall layout the locations of all proposed structures and pipelines using stakes or paint, taking into account all existing utilities as determined from the utility verification process. Layout is subject to the approval of the ENGINEER. Final location of lines shall be verified at the time of construction by the ENGINEER.

C. All equipment necessary and required for trenching, laying utility lines and appurtenances, backfilling, compaction and restoration shall be on the project before construction of this item shall be permitted to begin.

D. CONTRACTOR shall provide timely notification in writing to all corporations, companies, individuals or authorities owning above or below ground conduits, wires, pipes or other utilities running to property or encountered during excavating operations.

E. CONTRACTOR shall protect work in progress from unnecessary erosion or saturation. If CONTRACTOR's action or failure to act results in on-site materials becoming unacceptable for use, the CONTRACTOR shall remove unacceptable fills and provide acceptable fill as directed by the ENGINEER and at no cost to the OWNER.

F. Cap or remove and relocate services as required by the Contract.

G. Protect, support, and maintain conduits, wires, pipes, or other utilities that are to remain as required by OWNER.

3.02 EXAMINATION

A. Proof-roll and examine subgrades and surfaces to receive fill within influence zone to determine existence of soft areas, areas loosened by frost action or softened by flooding, groundwater or weather or existence of unsuitable materials.

B. Where sensitive soils are encountered, requirement for proof-rolling shall be waived, and CONTRACTOR shall perform alternate field testing to determine existence of soft areas.

B. Compaction requirements shall be 95% of the maximum dry density as determined by ASTM D-698 Standard Proctor with the exception of areas which will be under any structures. All areas which will have structures installed shall be compacted to 98% of the maximum dry density and determined by ASTM D-698 Standard Proctor.

C. Method of alternative testing shall be approved and coordinated with ENGINEER.

D. Trench stabilization methods for trenching in soft soils are detailed in the Contract Drawings.

3.03 SHEETING, SHORING, AND BRACING

A. Whenever necessary to prevent caving during excavation and to protect adjacent structures, property, workers, and public; excavations shall be sheeted, shored, and braced.

B. Where sheeting, shoring, and bracing is required, drive/install to prevent soil from entering excavation below or through sheeting.

C. Keep sheeting in-place until structure is placed, tested, and backfilled.

D. Remove sheeting, shoring, and bracing in manner not damaging structure or permitting voids within backfill.

E. Fill settled areas remaining after sheeting has been pulled with sand or other approved material.

3.04 FILL USAGE

A. The types and minimum thickness of fill and bedding materials shall be as shown on the Contract Drawings.

B. On-site cut soil may be utilized as fill (but not as structural fill) if soil meets the criteria as provided in Part 2 of this Specification and has an acceptable moisture content, and contains no deleterious materials as detailed in these specifications.

3.05 SUBGRADE PREPARATION

A. CONTRACTOR shall fill all settled areas where excavations or trenches were backfilled as well as holes made by demolition, tree removal, and site preparation work.

B. Remove and replace or recompact natural soils or compacted fill softened by frost, flooding, groundwater or weather as designated by ENGINEER.

C. Remove frozen soils within influence zone and replace with structural fill.

D. All subgrade locations shall be proof-rolled by CONTRACTOR and approved by ENGINEER prior placement of fill.

3.06 EXCAVATION

A. Excavate to elevations and dimensions necessary to complete construction as shown on the Contract Drawings.

B. Trenching Tolerances:

1. Excavate so pipes, ducts, and conduits can be laid straight at uniform grade, without sags or humps, between elevations shown on Contract Drawings.
2. Trenches for the installation of gravity sewer mains shall be of sufficient depth so that the top of the pipe when installed will not be less than forty eight (48) inches below the surface of the finished grade and not less than sixty (60) inches for force mains. The maximum width for the trench shall be as shown on the plans. Where conditions prohibit excavation to required depth and when approved by ENGINEER, pipe insulation shall be used as approved by the ENGINEER.
3. Excavation for manholes and appurtenances shall be sufficient to leave twelve (12) inches clear space between the structure and the bank, timber, or box which may be used to hold or protect the bank and to compact the backfill properly.
4. Maximum width at surface of ground shall not exceed width of trench at top of pipe by more than 2 ft without permission of ENGINEER, unless specifically shown on Drawings.
5. Minimum trench width shall be as shown on the plans.
6. Excavate electrical duct or conduit trenches as required so top of concrete encasement or top of conduit shall be as shown on Contract Drawings.

C CONTRACTOR shall protect all shade trees, utility poles and private property along the line of the work, and shall provide for the protection of the public.

D. Temporarily support and secure or cap, remove and relocate utility services in accordance with instructions by owners of services.

E. Protect, support, and maintain conduits, wires, pipes, and other remaining utilities in accordance with requirements of owners of said services.

F. Remove and replace or compact natural soils or compacted fills softened by frost, flooding, or weather.

G. Remove unsuitable material from within trenches as ordered by the ENGINEER.

H. Stabilize trench bottom and replace unsuitable material with Pipe Bedding and Filter Fabric as required by the ENGINEER and shown on the Contract Drawings.

I. Trench Dewatering:

1. The CONTRACTOR shall build all drains and do all ditching, pumping, bailing, and all other work to keep the excavation clear of ground water, sewage, or storm water during the progress of the work and until the finished work is safe from injury.

2. Where suitable construction conditions cannot possibly be obtained by other methods, the CONTRACTOR shall install and operate a wellpoint de-watering system to drain the excavation effectively.

3. Wellpoint systems shall be sufficient in size to dewater excavations 24 inches below subgrade and shall be capable of maintaining the water table at such an elevation until the work required to be constructed in the dry is completed and until all structures will be safe from floatation due to high ground water. The CONTRACTOR is fully responsible for all such structures. Wellpoint systems shall be designed and supervised by a reputable de-water equipment supplier or contractor. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the ENGINEER, and in accordance with all applicable local, state and federal requirements.

J. Do not advance excavation of trenches more than 300 ft ahead of completed pipe installation. The ENGINEER reserves the right to control the length of trench to be opened in advance of pipe installation; if, in his opinion, the pipe laying and installation of appurtenances and services are not proceeding fast enough to complete the installation of pipe and backfilling with a reasonable length of time, the opening of additional trench will not be permitted.

K. Do not excavate for manholes and other structures until scheduled for construction.

L. Do not excavate within influence zone of existing footings or foundations without prior approval of ENGINEER.

M. Upon completion of excavation, notify ENGINEER before proceeding with further Work.

N. Excavation of Rigid Surfacing:

1. Remove width 1 ft beyond anticipated edge of excavation.

2. Saw cut to ensure straight joint.

3. Surface replacement shall match existing surfacing unless otherwise shown on the contract Drawings.

O. Excavation across Roadways:

1. Excavation, backfill, and surface replacement shall conform to requirements as shown on the Contract Drawings. In no case shall surface replacement edges bear on less than 12-in. of undisturbed soil.

2. CONTRACTOR shall excavate trenches in which to place the new pipe lines. The depth and width of excavation shall be as shown on the Contract Drawings.

3. CONTRACTOR shall neatly saw cut all pavement and sidewalks prior to excavation.

a. The pavement shall be properly disposed of according to all Local, State and Federal regulations.

4. CONTRACTOR shall place and compact Pipe Bedding to bed the pipe and to cover the pipe to the depth shown on the Contract Drawings above the crown of the pipe (the "Pipe Zone").

5. For Work beneath roadways, CONTRACTOR shall use Select Granular Fill or Controlled Low Strength Material (flowable fill) to backfill the trench from the top of the Pipe Zone to the bottom of the Subbase as shown on the Contract Drawings and AOBE.

6. CONTRACTOR shall place and compact crushed stone # 2 in the Pipe Zone to protect pipes that are subject to damage by abrasion (e.g. PVC pipe), in wet areas, or as ordered by the ENGINEER.

7. For Work beneath roads, CONTRACTOR shall place and compact Subbase Course, Type RC-1 as the subbase course beneath paved surfaces and structures as shown on the Contract Drawings.

8. CONTRACTOR shall place backfill materials in lifts and compact to achieve the in-place densities specified herein.

3.07 SHEETING AND BRACING

A. If ordinary open-cut excavation is not possible or advisable, sheeting and bracing shall be furnished and installed in such excavation to prevent damage and delay to the work and to provide working conditions which are safe and acceptable to the New York State Department of Labor. Unless the sheeting and bracing is to remain in place, it shall be removed as the work progresses - in such a manner as to prevent the loosening and caving of the sides of the excavation and to prevent damage to finished work or adjacent structures and property. As soon as it is withdrawn, all voids left by the sheeting and bracing shall be filled with sand, crushed stone, or acceptable granular material and compacted.

A. Sheeting and bracing shall be installed at all locations shown on the Plans or as ordered by the ENGINEER. However, nothing in these Specifications, nor any failure upon the part of the ENGINEER or the OWNER to order installation of sheeting and bracing, nor any comments regarding the method of sheeting and bracing shall be construed as relieving the CONTRACTOR from full responsibility for the safety and adequacy of such work. The CONTRACTOR shall retain full responsibility for safeguarding the finished work, the workmen, the public, and adjacent property, and shall take whatever measures believed necessary to do so, including sheeting and bracing of excavations, even though such measures may not have been shown or ordered by the ENGINEER.

B. The CONTRACTOR may elect to use steel sheet piling for its convenience to facilitate construction, to help in de-watering operations, to protect the CONTRACTOR or others from damage to property or bodily harm, or for any other reason; however, an additional payment will not be made for this portion of the work.

3.08 SUBSURFACE OBSTRUCTIONS

A. In excavating, trenching, laying pipe, and backfilling, care must be taken by the CONTRACTOR not to remove, disturb, or injure other pipes, conduits, cables, or structures, without the permission of the interested utility or the approval of the OWNER. If necessary, the CONTRACTOR shall, at its own expense, sling, shore up, and maintain such structures, in operation and shall repair any damage done thereto within a reasonable time. Repair of damages to such facilities shall be made to the satisfaction of the ENGINEER and the utility.

B. The CONTRACTOR shall give sufficient notice in writing to the interested utility of its intention to remove or disturb any pipe, conduit, structure, etc., and shall abide by the utility regulations governing such work. In the event sub-surface structures are broken or damaged in the prosecution of the work, the CONTRACTOR shall immediately notify the proper authority and shall be responsible for any damage to person or property caused by such damage.

C. When pipes, conduit, structures, etc. providing service to adjoining buildings are broken during the progress of the work, the CONTRACTOR shall repair them at once at its own expense, or, if preferred by the utility involved, shall pay the utility the proper charges for having such repairs made by the utility's own force. Delays such as would result in buildings being without service overnight or for needlessly long periods during the day will not be tolerated, and the OWNER reserves the right to make repairs at the CONTRACTOR's expense without prior notification. Should it become necessary to move the positions of a pipe, conduit, or structure, it shall be done by the CONTRACTOR in strict accordance with instructions given by the ENGINEER or the utility involved.

3.09 SURFACE OBSTRUCTIONS

A. CONTRACTOR shall take every precaution to carefully protect all buildings, fences, walls, utility poles, trees, bridges, railroads, and other improvements from injury or damage, and, in the event of damage or removal of any of the foregoing obstructions during the progress of the work, they shall be repaired or replaced in a satisfactory manner (equal or better condition) - at the CONTRACTOR's expense - before final acceptance of the project.

3.10 OBSTRUCTION OF STREETS AND PREMISES

A. Excavated material shall be kept clear of sidewalks and interfere as little as possible with facility vehicular traffic except where local conditions make other arrangements necessary; in such event, the CONTRACTOR shall receive appropriate instructions from the ENGINEER in writing.

B. The CONTRACTOR will not be permitted to close both sides of a double roadway street to vehicular travel, except by written permission from the OWNER for a specified period of time. As required and directed by the ENGINEER, the CONTRACTOR shall bridge the trench in a proper and secure manner so as to prevent any serious interruption to travel upon the roadway or sidewalk and to afford necessary access to particular public premises. The cost of all such work must be included in the prices paid for various pay items, and the CONTRACTOR shall receive no extra compensation for this work.

C. Special care must be taken to give free access to all fire hydrants, water valve boxes and fire alarm boxes.

3.11 PREPARATION OF PIPE FOUNDATION

A. The bottom of trenches for sewer and water main installation shall be excavated to a minimum depth 6 inches below the bottom of pipe grade. Bedding material shall be installed per the Contract Drawings. If the material in the trench is of such character that a firm foundation for pipe cannot be secured, such material shall be removed to a depth below grade as ordered by the ENGINEER, and the extra excavation replaced with crushed stone # 2 as ordered by the ENGINEER and thoroughly compacted to form an unyielding foundation.

3.12 PLACEMENT OF BACKFILL

A. The trenches shall not be backfilled until the pipe work and appurtenances have been approved by the ENGINEER. The ENGINEER reserves the right to order any trench or trenches backfilled at any time after the installation of the pipe and appurtenances if, in the ENGINEER's opinion, the particular open trench or trenches constitute a public nuisance.

B. Do not use frozen material or place fill on frozen subgrade.

C. Use of Backfill Materials

1. Select Granular Fill: Select granular fill shall be placed to the lines and grades as shown on the plans, as outlined herein, as outlined in section 022200 and as outlined in the Geotechnical Report. Fill shall be placed in loose lifts that will result in a maximum lift thickness of 8 inches. Each lift shall be compacted using vibratory equipment and shall be compacted to a minimum of 98% of the maximum dry density in all areas beneath structures and 95% of the maximum dry density in all other fill areas as determined by the Standard Proctor according to ASTM D-698.

2. Pipe Bedding: Crushed Stone #1 and #2 shall be used to bed the pipe to the lines and grades as shown on the plans. The Pipe Zone shall be backfilled with select granular fill as shown on the Plans. The Pipe Zone extends from a depth of 6 inches below the invert of the pipe to an elevation shown on the Drawings. Bedding shall be placed in loose lifts that will result in a maximum lift thickness of 8 inches. Each lift shall be compacted using vibratory equipment and shall be compacted to a minimum of 95% of the maximum dry density as determined by the Standard Proctor according to ASTM D-698.

3. A minimum of twelve (12) inches of Subbase Course Type RC-1 material will be required under all roads as shown on the plans. Driveways, sidewalks, curbs or other structures or utilities requiring firm support shall be installed as shown on the plans. Subbase material shall be compacted using vibratory equipment and placed in lifts and thoroughly compacted in a manner approved by the ENGINEER.

4. Hand grade and rake bottom of trench to establish uniform trench gradient.

5. Excavated materials which are clean, consisting of earth, loam, sandy clay or other material approved by the ENGINEER in the field (Acceptable Earth Fill) may be used by the CONTRACTOR to backfill the trench excavation from the top of the Pipe Zone to the bottom of the subbase fill for work beneath all roads. Acceptable Earth Fill shall be free of large clods of earth, debris, pavement, abandoned pipe, structures or trash, rock or boulders over 4" diameter and soils containing vegetable or organic matter such as muck, peat, organic silt or any other deleterious matter.

6. All other stone materials shall be placed in a maximum 8 inch lift and compacted as necessary using reasonable means as approved by the ENGINEER.

D. Where pipes or electrical ducts cross, protect piping or ducts at higher elevation by backfilling trench within higher pipe or duct influence zone down to bedding of lower pipe or duct with #1 and #2 stone or with flowable fill when directed by the ENGINEER.

E. Where pipes or electrical ducts leave structures, protect by backfilling pipe or duct influence zone down to undisturbed soil with structural or controlled fill.

F. Do not backfill until new concrete have properly cured, coatings approved and required tests accepted.

G. Place fill simultaneously on both sides of free-standing structures.

H. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials. When approved by ENGINEER, jetting, flooding, puddling or vibroflotation methods may be used for compacting if CONTRACTOR furnishes test results to confirm required degree of compaction being obtained uniformly throughout entire mass.

I. The trenches shall be backfilled with the materials specified on the Contract Drawings. The material shall be carefully placed in the trench so as not to move the pipe and compacted as specified below. Compactive effort is subject to the approval of the ENGINEER with specific areas requiring added compaction as directed by the ENGINEER.

J. Backfill materials shall be placed in lifts and compacted to the satisfaction of the ENGINEER. Maximum lift thicknesses and the requirements for compaction are specified herein.

3.13 EXCESS MATERIAL

A. CONTRACTOR shall at CONTRACTOR’s expense:

1. Stockpile excavated material suitable for backfill on site.

2. Place material as ordered by ENGINEER on-site.

3. Remove material not required by OWNER from site and provide for proper disposal.

B. OWNER has first right to excess excavated material suitable for backfilling or site grading, not required at job site.

3.14 MAINTENANCE

A. The CONTRACTOR shall maintain all excavated areas by refilling for settlement, until final acceptance of the project in accordance with the applicable articles of the "General Conditions" and other requirements of these Specifications.

3.15 EROSION CONTROL

A. Conduct site grading and drainage operations to prevent excessive soil erosion from construction site Work area.

B. Provide means to prevent or minimize movement and washing of soil onto pavements or into adjacent ditches, swales, inlets, and drainage pipes to avoid possibility of drainage structures becoming clogged with soil.

C. Remove soil and debris from structures, pipes, ditches, and other appurtenances to restore proper functioning.

D. Protect water quality in all receiving streams, as required in the Special Conditions Section

3.16 CLEANING UP

A. The CONTRACTOR shall remove all excess excavated material, rubbish, and debris from adjacent street surfaces, gutters, sidewalks, parking areas, grass plots, highway and railroad rights-of-way, etc., and the project as a whole shall be left in a neat and acceptable condition.

END OF SECTION

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SECTION 022250
GEOTEXTILES

PART 1 GENERAL

1.01 SUMMARY

Under this Section, the CONTRACTOR shall furnish and install geotextile products for various applications including, but not limited to, behind rip rap, stone fill, use in roadways, trenches, driveway tubes, sedimentation control fencing, under structures, and as shown on the plans.

1.02 SUBMITTALS

The CONTRACTOR shall provide the following submittals to the ENGINEER in accordance with the Standard Specifications:

A. Geotextile - Manufacturer's technical information and data on material construction and physical and chemical properties.
B. 6" x 6" material sample.

PART 2 PRODUCTS

2.01 MATERIAL

A. Non-Woven Geotextile - Mirafi 140N, or approved equal
B. Woven Geotextile – Mirafi 600X, or approved equal

PART 3 EXECUTION

3.01 INSTALLATION

Install in accordance with manufacturer's recommendations and details shown on the Contract Drawings and in these Specifications.

Woven Geotextile shall be installed beneath rip rap and stone fill where rip rap and stone fill is shown in Contract Drawings.

END OF SECTION

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SECTION 026100
PIPELINE INSTALLATION

PART 1. GENERAL

1.01 WORK SPECIFIED

Installation of all metallic and non-metallic pipe, conduit, fittings and specials of the type and quality as shown in the pipe schedule or on the Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Trenching and Excavation
B. Ductile Iron Pipe
C. Flexible Pipe Couplings
D. Leakage Test
E. Disinfection of Water mains
F. Sanitary Sewer Work
G. Storm Sewer Work

1.03 SUBMITTALS

Test reports, certifications, manufacturer's technical data, installation instructions, and shop drawings are required for each type of pipe to be installed.

Layout drawings are required for the pipeline to be installed within structures showing the location including the support system restraint, sleeves, and appurtenances.

PART 2. PRODUCTS

2.01 PIPE

A Materials for the piping, joints and fittings shall be as specified in the section for the type of pipe to be installed, shown in the pipe schedule or on the Contract Drawings.

B Pipe and appurtenances shall comply with the applicable standards for its type of material.

2.02 JOINTS

A. Type of joints shall be as scheduled in the pipe schedule or as shown or noted on the Contract Drawings or Specifications.

B. Grooved and shoulder type joints of the rigid design may be used in lieu of flanged joints on the ductile iron or steel pipe with the prior acceptance of the ENGINEER.

2.03 INSPECTION

A Pipe and appurtenances shall be inspected by the CONTRACTOR in the presence of the ENGINEER on delivery and prior to installation for conformance with the standards and specifications.

B Materials not conforming to the standards and specifications shall not be stored on the site but removed at once and replaced with materials conforming to the specifications.

PART 3. EXECUTION

3.01 INSTALLATION - UNDERGROUND

A. General

1. Excavation and backfilling shall be in accordance with the applicable provisions of the Section entitled “Excavation and Backfill”.
2. Blocking will not be permitted under pipe, except where the pipe is to be laid with concrete cradle or encasement.
3. No pipe shall be laid on a foundation in which frost exists, or at any time when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
4. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris or water.
5. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.
6. A 2” wide detectable warning tape with continuous wording “CAUTION: BURIED PIPELINE BELOW” shall be installed not greater than 24 inches and not less than 12” above all pipelines.
7. Waterline installation shall conform to AWWA C600-93.

B. Location and Grade

1. Pipelines and appurtenances shall be located as shown on the Contract Drawings or as directed and as established from the control survey in accordance with the Special Provisions.
2. The alignment and grades shall be determined and maintained by a method acceptable to the ENGINEER.
3. All water lines shall be buried a minimum of 5 feet from top of pipe.

C. Subgrade

1. The subgrade for pipelines shall be earth or special embedment as specified or directed and shall be prepared in accordance with the Section 022210.

D. Joints

1. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer’s recommendations.

E. Wrapping of Pipe

1. Ductile iron pipe and fittings shall be wrapped in polyethylene per AWWA standards. Use proper restraints for polyethylene encased pipe,

F. Embedment

1. Embedment shall be deposited and compacted in accordance with the Contract Drawings.

G Thrust Restraints

1. Pressure pipelines shall have thrust restraints in the form of mechanical restraints of the size and type specified or as required by the pressure and stability of the supporting surface.
2. Thrust restraints shall be installed at all changes in direction, changes in size, dead ends or other locations where shown.
3. Thrust restraints shall be in place, and when of concrete (in accordance with Section 033000 – Concrete) shall have developed the required strength, prior to testing of the pipeline.

4. Tie rods and nuts for thrust restraints shall be of high tensile steel and shall have a minimum yield strength of 70,000 psi.
5. Tie rods and nuts installed underground shall be coated with two coats of coal tar pitch preservative coating after installation.

3.02 INSTALLATION – EXPOSED/ABOVE GROUND

Exposed pipelines shall be carefully erected, neatly arranged, and run parallel to wall of structure.

Supports and anchors shall be adequate to support the pipe filled with water with a minimum safety factor of 5 and for test pressure specified.

Special supports shall be as specified in the Section for the type of pipe being installed.

All water pipelines and fittings shall be wrapped in closed-cell foam insulation and sealed to prevent condensation.

All exposed PVC piping shall to be painted unless it is covered by insulation.

3.03 CUTTING AND SPECIAL HANDLING

Field cuts of pipes shall be in accordance with the manufacturer's instructions.

Where a pipe requires special handling or installation it shall be in accordance with the Section for that type of pipe.

3.04 FLEXIBLE COUPLINGS

Flexible couplings shall be provided where shown or scheduled.

3.05 WALL CASTINGS AND SLEEVES

All pipelines passing through walls, floors or slabs of structures shall be installed in a wall casting or sleeve. The wall castings and sleeves shall be in accordance with the Section 150950.

3.06 LEAKAGE TEST

All pipelines shall be tested for leakage in accordance with the Section 026600.

3.07 CHLORINATION

All pipelines designed to convey potable water shall be chlorinated in accordance with Section 025100.

3.08 TRACER TAPE

All pipelines constructed of either PVC or HDPE shall be buried with detectable tracer tape for PVC and tracer wire for HDPE installed per manufacturer's recommendations. Tracer tape and tracer wire shall be Trumbull Industries or approved equal.

3.09 ADJUSTMENT OF UTILITY COVERS TO GRADE

The CONTRACTOR shall adjust the existing facilities such as water valves, valve boxes, and any other utility to grade, alignment, and slope of the finished roadway as determined by OWNER.

The CONTRACTOR shall support and protect all existing utilities within his work area. All manholes, frames and covers and water valve boxes of all existing utilities disturbed or exposed by construction shall be adjusted by the CONTRACTOR to one-quarter inch (1/4") below new finished grade elevations prior to placement of final pavement.

END OF SECTION

SECTION 026150
DUCTILE IRON PIPE

PART 1 GENERAL

1.01 SUMMARY

1. Work Specified- Centrifugally cast cement lined ductile iron pipe and fittings of the thickness class as specified in the pipe schedule or as shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. Section 022210 – Trenching and Excavation
B. Section 026100 – Pipeline Installation
C. Section 026600 – Hydrostatic Pressure and Leakage Testing
D. Section 150100 – Gate Valves
E. Section 150150 – Butterfly Valves

1.03 REFERENCES

A. Applicable Codes, Standards and Specifications
   1. American National Standards Institute (ANSI)
   2. American Water Works Association (AWWA)
   3. American Society for Testing and Materials (ASTM)

1.04 MATERIALS

A. Ductile Iron pipe and fittings shall comply with the following ANNI/AWWA standards:

Ductile Iron Pipe	C151
Fittings	C110
Joints-Mechanical and Push-On	C111
Joints-Flanged	C115
Cement Lining	C104
Polyethylene Encasement	C105

B. All piping shall be Class 52. Where pipe rating is reduced by threading, increase pipe weight to Class 53.

C. All pipe shall be manufactured in the United States and shall be new and of first class materials and construction.

D. All shipments of material shall be tested in accordance with the provisions for testing in the applicable standards.

1.05 SUBMITTALS

A. The manufacturer shall furnish sworn statements that all of the specified tests have been made and the results thereof comply with the requirements of the specified standards.

B. Pipe and joint details.

C. Layout drawings for Ductile Iron Pipe to be installed within structures showing the location including details of the support system, sleeves and appurtenances.

PART 2 PRODUCTS

2.01 PIPE

A. General Requirements

1. All buried Ductile Iron pipe and fittings shall comply with the following standards:

	ANSI/AWWA
Ductile Iron Pipe	C151
Fittings	C110
Joints-Mechanical and Push-On	C111
Joints-Flanged	C115
Cement Lining	C104
Polyethylene Encasement	C105

B. Buried Pipe

1. All buried pipeline scheduled to be ductile iron shall be ductile iron pipe, class 52, cement lined conforming to ANSI/AWWA C151/A21.51 specifications.

C. Interior Pipe

1. All interior gallery piping shall be ductile iron pipe, class 53 (where threaded) conforming to ANSI/AWWA C115/A21.15 specifications.
2. All interior piping and fittings shall be exterior primed for painting.

D. Manufacturers for Push-on Joint Pipe
1. American Pipe Product: Fastite Joint
2. U. S. Pipe Product: Tyton Joint
3. Griffin Pipe Product: Super Bell-Tite Joint
4. Clow Product: Tyton Joint or Fastite Joint

E. Manufacturers for Mechanical Joint Pipe
1. American Pipe Product: Flex-Ring
2. U. S. Pipe Product: TR FLEX
3. Griffin Pipe Product: SNAP-LOK
4. Clow Product: Restrained Tyton or Restrained Fastite

2.02 CEMENT MORTAR LINING AND BITUMINOUS COATING

A. AWWA C104.
B. Thickness: Not less than 1/16 in.
C. Do not steam cure cement mortar lined pipe and fittings.
D. Apply bituminous seal coat over cement lining on inside of pipe. Coating shall be smooth, tough, tenacious, and impervious to water without any tendency to scale off and shall not be brittle.

2.03 POLYETHYLENE PIPE ENCASEMENT

A. Shall be 8 mil polywrap film manufactured of 100 % polyethylene material conforming to ASTM D 4976 Group 2 (Linear).
B. Shall be manufactured in accordance with ANSI/AWWA C105.
C. Pigmentation
   a. Natural when exposure to ultraviolet light, such as sun, is less than 48 hours.
   b. 2.0 to 2.5% well-dispersed carbon black with stabilizers when exposure to ultraviolet light is 2 to 10 days.
D. Material: Virgin polyethylene produced from Dupont Alathon or USI Petrothene resins.
E. Method of manufacture: Extruded tube form.
F. Closure Tape: Polyhen #900 or Scotchrap #50, 2" wide, plastic backed, adhesive tape.
G. Flat tube widths:

Nominal Pipe Sizes	Push-on Joint Flat Tube Width	Mechanical Flat Tube Width
6"	17"	20"
8"	21"	24"
10"	25"	27"
12"	29"	30"
14"	33"	34"
16"	37"	37"
18"	41"	41"
20"	45"	45"
24"	53"	53"

2.04 FITTINGS

A. All fittings shall conform to ANSI/AWWA C110/A21.10 specifications.
B. Buried Pipe Fittings
   1. All fittings for buried piping shall have compact ductile iron mechanical joints and shall conform to ANSI/AWWA C111/A21.11 specifications.
   2. All fittings for buried pipe shall be cement mortar lined with bituminous coating

2.05 PIPE INSULATION

A. Pipe Insulation shall be 2” thick Pittsburgh Corning FOAMGLASS insulation or approved equal.
   1. Shall include pit wrap with the pipe insulation.
B. Pipe insulation shall be installed only where as shown on the Contract Drawings and AOBE.

2.06 JOINTS

A. The type of joints for ductile iron pipe and fittings shall be as scheduled in the pipe schedule and/or as shown on the Contract Drawings.

2.07 VALVES

A. Buried Piping Valves
   1. For valve types refer to Sections 150100 and 150150.
   2. All valves shall open when turned counterclockwise unless otherwise noted.
   3. Valve box shall be slide type and “water” or “sewer” shall be cast on cover.
   4. All valves shall be manufactured in United States, and shall be Clow or approved equal.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. Trench, backfill, and compact in accordance with Sections 022210.

B. Restrain piping and fittings at changes of alignment and at dead ends in accordance with pipe restraint details on Contract Drawings.

C. All ductile iron pipe and fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks or chains will not be permitted.

D. Adjust all hydrants, valve boxes, curb boxes, post blow-offs, buried post blow-off covers, manhole covers and other appropriate facilities to finished grade.

E. Cut polyethylene encasement in lengths 2 feet longer than the pipe section and place around the pipe.
   1. Install polyethylene encasement according DIPRA's "Polyethylene Encasement Installation Guide"
   2. Overlap the joint with the polyethylene tube and secure in place with closure tape, after the pipe joint has been made.
   3. Fold tube over at the top and secure at quarter points along the pipe section.
   4. Remove and replace all damaged tubes.

3.02 JOINTS

A. Mechanical joints shall be assembled in accordance with the notes on Method of Installation, AWWA C111, Appendix A. All bolts shall be tightened by means of torque wrenches such that the follower shall be brought up evenly. If effective sealing is not obtained at the specified torques, the joint shall be disassembled, cleaned and reassembled.

B. Push-on joints shall be assembled using lubricant furnished by the manufacturer. The joint shall be made by guiding the plain end into the bell until contact is made with the gasket and exerting sufficient force to drive the pipe home until penetration is made to the depth recommended by the manufacturer.

C. Flanged joints shall be assembled with through bolts of the size required for the pipe being installed. Stud bolts shall be used only where shown or required. Connecting flanges shall be in proper alignment and no external force shall be required or used to bring them together.

   1. Flanges for flanged joints shall be drilled for 125 psi pressure unless otherwise specified.
      a. Flange bolts and nuts shall low alloy, corrosion resistant steel, except where other materials are called for in the pipe schedule.
      b. Gaskets for water and sewage piping shall be 1/8 inch thick of the ring type of cloth inserted rubber unless otherwise specified.
      c. Gaskets for other service shall be as specified.

D. Restrained flange adapters shall be installed as required. Restrained flange adapers shall be "RFCA" manufactured by Romac or approved equal. Set screws shall be tightened using a torque wrench to the torque specified by the manufacturer.

E. Bolted Couplings shall be Hymax Pipe Coupling or approved equal.

F. Restrained bolted coupling shall be 400RG manufactured by Romac or approved equal for pipes 12”-48” and Alpha Wide Range manufactured by Romac or approved equal for pipes 4”-12”.

G. Grooved and shoulder type joints of the rigid design may be used in lieu of flanged joints with the prior acceptance of the Engineer and shall be in accordance with AWWA C606 and Table 5 for iron pipe.
1. Bolts and nuts shall be cadmium plated steel.
2. Details of supports, anchors and couplings shall be submitted for review.

H. Field Lock Gaskets shall be used to restraint the pipe per the Contract Drawings.
1. Shall be US Pipe Field Lok or approved equal.

3.03 COATING, PAINTING AND LINING

A. Coating, painting and lining shall be as follows unless otherwise specified in the pipe schedule:

1. Pipe installed in the ground, in exposed exterior locations, in contact with water or inside structures but not scheduled for painting:
   a. Interior: Bituminous coating or standard thickness cement lining with sealcoat unless otherwise specified.
   b. Exterior: Bituminous coating.

2. All exposed piping, both interior and exterior shall be finished per Section 09910 with the following exceptions.
   a. Interior: Nothing
   b. Exterior: Pipes with bituminous coatings shall be coated with Inertol "Tar Stop", or Mobil Anti-Bleeding Sealer Aluminum 13-A-1 or equal, or sandblasted as specified, before additional coats described in the piping schedule to receive field painting, a shop prime coat of TNEMEC Series 69 Hi-Build Epoxyliner or equal may be supplied. If a shop prime is applied, the field prime specified in the Section 099100 shall be touch up only.

B. Polyethylene encasement shall be supplied and installed per DIPRA Guidelines on those sections of the pipe as indicated on the Plans or AOBE.

3.04 DISINFECTION

A. Disinfect all potable water pipes and appurtenances in accordance with AWWA C651.

B. Comply with all requirements of the New York State Department of Health for disinfection of potable water lines, valves, hydrants, and appurtenances.

C. Products

1. Acceptable disinfectants are
   a. Hypochlorites.

2. Test Kits
   a. High range test kit for chlorine residual (0-200 mg/1) Hach Chemical Co. Model CN-21P.
   b. DPD chlorine residual test kit (0-3.5 mg/1) Hach Chemical Co.

Model CN-66.

c. Test kits to remain property of the Contractor.

D. Flush mains with clear water at a minimum rate of 2.5 fps prior to disinfection. See Table 1.

TABLE 1 – WATER MAIN FLUSHING DATA		
PIPE DIAMETER (INCHES)	**FLUSHING RATE GPM @ 2.5 fps**	**HYDRANT OPENINGS @ 40 psi**
2	25	one - 2-1/2
4	100	one - 2-1/2
6	220	one - 2-1/2
8	390	one - 2-1/2
10	610	one - 2-1/2
12	880	one - 2-1/2
18	1980	two - 2-1/2
24	3510	one - 4-1/2 and one - 2-1/2
30	5510	one - 4-1/2 and two - 2-1/2

E. Hypochlorites: Apply solutions to water mains with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions.

F. Application (Continuous Feed Method).

1. Connect chlorinator or force pump to water main upstream from point of repair or replacement, or new lines.
2. Proportion application rate of chlorine solution to obtain a minimum concentration of 50 mg/1 of available chlorine. Use high range test kit to determine concentration. See Table 2.

TABLE 2 - QUANTITY OF DISINFECTANT REQUIRED FOR 50 mg/l OF AVAILABLE CHLORINE PER 100 FT. OF PIPE							
PIPE DIAMETER (INCHES)	**POUNDS**		**OUNCES**			**QUARTS**	
	Cl GAS	**SOLUTION HYPOCHLORITE**					
		70%	**70%**	**14.7%**	**5.25%**	**14.7%**	**5.25%**
2	0.1	0.1	0.2	0.7	2.1	0.1	0.1
4	0.1	0.1	0.6	3.0	8.3	0.1	0.3
6	0.1	0.1	1.4	6.7	18.7	0.2	0.6
8	0.1	0.2	2.5	11.8	33.2	0.4	1.1
10	0.2	0.3	3.9	18.5	51.8	0.6	1.6
12	0.3	0.4	5.6	26.7	74.7	0.8	2.3
18	0.6	0.8	12.6	60.0	168.0	1.9	5.3
24	1.0	1.4	22.4	107.0	298.0	3.4	9.3
30	1.6	2.2	35	167	467	5.2	14.6

3. In the absence of a meter, determine rate either by placing a pitot gage at discharge or by measuring the time to fill a container of known volume. See Table 3.

TABLE 3 - TIME FOR DISINFECTANT TO FLOW THROUGH 100 FT. OF PIPE - MINUTES

PIPE DIAMETER (INCHES)	@ 25 GPM	@ 100 GPM	@ 500 GPM
2	1.0	0.25	0.05
4	3.0	0.75	0.15
6	6.0	1.5	0.3
8	10.0	2.5	0.5
10	16.0	4.0	0.8
12	24.0	6.0	1.2
18	53.0	13.25	2.6
24	94.0	26.0	5.2
30	147.0	37.0	7.4

4. Continue to apply chlorine solution until it reaches discharge. Check for the presence of chlorine at discharge by adding an orthotolidine reagent. In the presence of chlorine the reagent will turn red.

5. Maintain chlorinated water in the main for a minimum of 24 hours. At the end of this period chlorine concentration shall be at least 25 mg/1. Use high range test kit to determine concentration.

6. Operate all valves and hydrants to insure their proper disinfection.

7. Prevent back flow of super chlorinated water into existing distribution system.

G. Final Flushing:

1. Give the OWNER 72 hour notice prior to flushing any section of the main. The OWNER will review both the time and rate of flushing.

2. After a 24 hour retention period, flush main until maximum chlorine concentration is 1.0 mg/1. Use DPD chlorine residual test kit.

3. Water used to disinfect the water mains shall be dechlorinated prior to discharge. Only water free of chlorine (< 0.1 mg/l total residual chlorine) can be discharged to a surface water and the discharge of the chlorine-free water shall be performed in a non-erosive-manner that will not adversely affect plants and animals. The discharge shall comply with applicable State regulations for waste discharge.

4. Sodium thiosulfate or approved equal shall be used as the dechlorinating agent.

H. Bacteriological Tests:

1. Test water main in the presence of the ENGINEER for bacteriological quality before putting pipe into service. Contact local health units for sampling criteria and procedures. Pay all expenses incurred for testing.
2. Tests shall be conducted by a laboratory approved by the New York State Health Dept.

I. Give all test results to Engineer.

1. Should test results prove any part of the system bacteriologically unsafe, repeat disinfection procedures until satisfactory results are obtained.

K. Do not place the test section of pipe in service or install any services until written approval of the health sample is provided to the ENGINEER by the Health Department and approval is given by the ENGINEER to place the tested pipe section in service.

3.05 TESTING

A. See Section 026600 – Hydrostatic Pressure and Leakage Testing for test procedures.

END OF SECTION

SECTION 026600
HYDROSTATIC PRESSURE AND LEAKAGE TESTING

PART 1 – GENERAL

1.01 RELATED SECTIONS

A. Section 026150 – Ductile Iron Pipe
B. Section 033500 – Manholes, Concrete Structures and Vacuum Testing

1.02 REFEERENCES

A. AWWA C600
B. ASTM F2164

1.03 WORK INCLUDED

A. Testing of all hydraulic structures, pressure and non-pressure piping for leakage as specified.
    1. The CONTRACTOR shall furnish all labor, equipment, test connections, vents, water and materials necessary for carrying out the pressure and leakage tests.
    2. CONTRACTOR shall use potable water only.
B. All testing shall be witnessed by the ENGINEER or OWNER.

PART 2 PRODUCTS

(not used)

PART 3 – EXECUTION

3.01 LEAKAGE TESTS

A. If vacuum testing can not be performed on the concrete structures, a hydrostatic leakage test shall be performed.
B. Tanks, vaults, wells and other fluid containing structures, (excluding manholes), shall be tested after backfilling by filling the structure with water to overflowing, or other level as may be directed by the ENGINEER, and observing the water surface level twenty-four hours thereafter.
    1. When testing absorbent materials such as concrete, the structure shall be filled with water at least 24 hours before the test is started.
C. The exterior surface, especially at the construction joint, will be inspected for leakage during and upon completion of the 24-hour test.
    1. Leakage will be considered to be within the allowable limits when there is no visible sign of leakage on the exterior surface and where the water surface does not drop except as associated with evaporation.
    2. A slight dampness on the exterior wall surface during the test period will not be considered as leakage, except in the case of prestressed concrete structures.

3.02 TESTS ON PRESSURE PIPING FOR TRANSPORT OF WATER OR SEWAGE (FORCE MAINS)

A. General
1. The newly constructed water or sewer main shall be pressure tested according to ANSI/AWWA C600, Section 4: Hydrostatic Testing.
2. Take all necessary precautions to prevent dirt, debris, or other foreign material from entering the water or sewer main, services, or appurtenances. Remove such material from the water or sewer main, services or appurtenances at no additional expense to the Contract.
3. Pipelines designed to transport water or sewage under pressure shall be tested hydrostatically and for leakage prior to being placed in service.
4. The length of piping and sections included in the tests shall meet the approval of the ENGINEER, but shall not exceed 1,000 lineal feet.
5. The pipe shall be tested at whichever pressure is greater:
   1) 150 psi
   2) 1.5 times the working pressure of the pipe - See Contract Plans for Working Pressure.
6. Equipment in or attached to the pipes being tested shall be protected. Any damage to such equipment during the test shall be repaired by the CONTRACTOR at his expense.
7. When piping is to be insulated or concealed in a structure, tests shall be made before the pipe is covered.
8. All fittings, hydrants and appurtenances must be properly braced and harnessed before the pressure is applied. Thrust restraining devices which will become a part of the system must also be tested at the test pressure.
9. CONTRACTOR shall use potable water only. Water for flushing and testing lines shall be provided by the CONTRACTOR.
10. If the line fails the test, the CONTRACTOR shall explore for the cause of the excessive leakage and after repairs have been made the line shall be retested. This procedure shall be repeated until the pipe complies at no additional expense to the Contract and without extension of time for completion of the work.

B. Pressure Test
1. Test pressure shall be as scheduled at 1-1/2 times working pressure or where no pressure is scheduled at 150 psi.
2. Test pressure shall be held on the piping for a period of at least 2 hours, unless a longer period is requested by the ENGINEER.
3. The pressure test passes if the pressure remains within 5 psi of the original pressure.

C. Leakage Test for Ductile Iron and PVC Pipe
1. The leakage test shall be conducted concurrently with the pressure test.
2. The rate of leakage shall be determined at 15-minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three (3) consecutive 15-minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.
   a. At the completion of the test, the pressure shall be released at the furthermost point from the point of application.
3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating tests.
4. Unless the local standards are more stringent, use the following formula for allowable leakage (gph).

$$L\ (gph) = \frac{SD(P)^{1/2}}{133{,}200}$$

S = Length of pipe tested (feet).
D = Nominal diameter of the pipe, (inches).
P = Average test pressure during the leakage test, (psig).

5. Regardless of the above allowables, any visible leaks shall be permanently stopped.

D. Leakage Test for HDPE Pipe
   1. The leakage test shall be conducted concurrently with the pressure test.
   2. Shall be tested per ASTM F2164 – Non-Monitored Make-up Water Test
      a. The test procedure consists of initial expansion phase and test phase.
      b. Initial expansion phase
         1. Make-up water is added as required to maintain the test pressure for four (4) hours.
      c. Test phase
         1. The test pressure is reduced by 10 psi.
         2. If the pressure remains steady (within 5 % of the target value) for one (1) hour, no leakage is indicated.
   3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating tests.
   4. Any visible leaks shall be permanently stopped.

E. Leakage Test for PCCP Pipe
   1. The leakage test shall be conducted concurrently with the pressure test.
   2. The rate of leakage shall be determined at 15-minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three (3) consecutive 15-minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.
      a. At the completion of the test, the pressure shall be released at the furthermost point from the point of application.
   3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating tests.
   4. The line will not be accepted until this measured quality is less than 10 gallons per inch of diameter per mile of pipe per 24 hours. All visible leaks must be repaired regardless of the measured leakage.
   5. Regardless of the above allowables, any visible leaks shall be permanently stopped.

END OF SECTION

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SECTION 027200
POLYVINYL CHLORIDE (PVC) GRAVITY PIPE SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for installation of all polyvinyl chloride pipe (PVC) to be utilized for gravity sewers, fittings and appurtenances as specified herein for the sanitary sewer system, as shown on the Drawings and in accordance with the Specifications.

B. The CONTRACTOR shall be prepared to install PVC pipe and fittings in conjunction with the earthwork and other related components of work.

1.02 RELATED SECTIONS

A. Section 022210 – Trenching and Excavation
B. Section 026010 – Sanitary Sewer Work
C. Section 026310 – Manholes and Drainage Structures
D. Section 026600 – Leakage Test

1.03 SUBMITTALS

A. The CONTRACTOR shall submit to the OWNER for approval within 14 days prior to the start of pipe work, complete, detailed shop drawings of all PVC pipe and fittings, a list of materials to be furnished, and the name of the pipe manufacturer.

B. The CONTRACTOR shall submit to the ENGINEER the PVC pipe manufacturer's certification of compliance with herein.

C. CONTRACTOR shall submit all quality control information and quantity records as outlined in Section 013300 on a minimum basis of once per week during active work under this specification.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) COMPOUND

A. SDR-35.
B. SDR-26 - ASTM D3034, Heavy Wall Non-Pressure Pipe.
C. Push-on joint - ASTM 3212-92.

2.02 PVC PIPES AND FITTINGS

A. SDR-26 (ASTM D3034, Heavy Wall Non-Pressure Pipe)
B. PVC pipes and fittings shall be homogeneous throughout and free of visible cracks, holes foreign inclusions, or other deleterious effects, and shall be uniform in color, density, melt index and other physical properties.

C. All plastic sewer pipe and fittings shall meet the requirements of ASTM D3034. The standard dimension ratio (SDR) of all pipe and fittings shall not exceed 35 unless otherwise specified.
D. All pipe shall be suitable for use as gravity sewer pipe. Sizes and dimensions shall be as designated in ASTM D3034. Standard laying lengths shall be 13 feet or 20 feet ± 1 inch. At manufacturer's option, random lengths may be shipped not to exceed 10% of total footage.
E. All joints shall be of the bell and spigot type and conform to ASTM D3212 and/or Uni-Bell Uni-B-1. Gaskets shall be in accordance with ASTM F477. All bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket, which is positively retained. No solvent cement joints will be permitted in field construction except as specifically authorized by the engineer.
F. All fittings shall be furnished by the pipe supplier or approved alternate supplier. All fittings shall have a push-on joint, which is compatible with the pipe and conforms to ASTM D3034. Minimum Pipe Stiffness (F/Îy) at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM D2412.
G. Impact tests shall be conducted in accordance with ASTM D2444 and shall comply with the requirements given in ASTM D3034.
H. Infiltration shall not exceed 50 gallons/inch/mile/day.
I. Deflection tests for 100% of the pipe installed shall be conducted, although for small installations ENGINEER may waive this requirement. Deflection shall be measured by pulling a mandrel or other device through the pipe.

SDR Dimensions and Weights

Nominal Pipe Size Inches	Pipe O.D. Inches	SDR – 35			SDR – 26		
		Min Wall Inches	Weight Lbs./Ft.		Min Wall Inches	Weight Lbs./Ft.	
			20’ Length	40’ Length		20’ Length	40’ Length
4	4.215	.120	1.04	1.03	.162	1.38	-
6	6.275	.180	2.32	2.30	.241	3.08	-
8	8.400	.240	4.18	4.13	.323	5.57	-
10	10.500	.300	6.55	6.46	.404	8.74	-
12	12.500	.360	9.36	9.22	.481	12.41	-
15	15.300	.437	13.97	13.75	.588	18.65	-

Refer to Uni-Bell’s *Handbook of PVC Pipe* for dimensions and weights not shown in above table.

2.03 IDENTIFICATION

The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding 5 feet:

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size.
3. Schedule.
4. Manufacturing Standard Reference (e.g., ASTM D 3034-93).
5. A production code from which the date and place of manufacture can be determined.

2.04 TRANSPORTATION

Transportation of PVC pipe and fittings shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damage to the PVC pipe and fittings incurred prior to and during transportation to the site.

PART 3 EXECUTION

3.01 HANDLING AND PLACEMENT

A. Survey, Lines, and Grades

The ENGINEER has established a benchmark and lines, and grades shall be as established on the Contract Drawings. The CONTRACTOR will be responsible for the proper execution of the work to the lines and grades so established.

The CONTRACTOR shall take every precaution to protect all stakes and, should replacement become necessary, it shall be done at the CONTRACTOR's expense. The CONTRACTOR shall also furnish any supplementary lines and grades that may be needed for construction purposes, including blue-top grade stakes.

The CONTRACTOR shall stake the pipelines and appurtenances as to location, lines, and grades and shall furnish the ENGINEER with offset hub elevations (at a maximum of 50 feet o.c.) with corresponding stations of distance. He shall also furnish such other pertinent information as is necessary for proper measurement and determination of quantities. The ENGINEER will check all cut sheets before installation of any pipe.

Setting of grade by use of a laser instrument or device (in lieu of setting batter boards) is acceptable. Laser instruments shall be used in accordance with manufacturer's recommendations.

The CONTRACTOR will maintain an adequate power supply and provide continuous power ventilation in the pipeline, in accordance with the laser equipment manufacturer's recommendations, wherever the laser equipment is in use.

The adjustment of the laser equipment for accuracy shall be made by qualified personnel, using surveying instruments at the start of each day's pipe laying and at any time deemed necessary by the ENGINEER to assure accuracy of the laser alignment.

It is the CONTRACTOR's sole responsibility for the accuracy of the laser equipment; any section of pipe found to be at the wrong grade or to have settled, shall be dug up and relaid to the satisfaction of the ENGINEER and at the CONTRACTOR's sole expense.

In order to ensure pipe is being installed at the proper grade and alignment, offset hubs shall be set fifty (50') feet from the beginning manhole. These hubs shall be used to check line and elevation as pipe installation progresses.
As-built invert elevations shall be established by the CONTRACTOR at each manhole or cleanout and furnished to the ENGINEER prior to proceeding out of the manhole or cleanout with pipe toward the next manhole or cleanout.

3.02 INSTALLATION OF GRAVITY SEWERS AND FORCE MAINS

A. Excavating, Trenching, Backfilling and Compacting

Excavating, trenching and backfilling shall be done in accordance with Section 022210 of these specifications.

B. Sewer Relation to Water Mains

1. Horizontal Separation

Whenever possible, sewers should be laid at least 10 feet horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

a. It is laid in a separate trench, or

b. It is laid in the same trench with the water mains located at one side, on a bench of undisturbed earth, and if

c. In either case, the elevation of the top (crown) of the sewer is at least 18" below the bottom (invert) of the water main.

2. Vertical Separation

Whenever sewers must cross under water main, the sewer shall be laid at such an elevation that the top of the sewer is at least 18" below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with push-on type joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

3. Special Conditions

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the water main should be constructed of a push-on or mechanical-joint ductile iron pipe, and the sewer constructed of C-900 PVC pipe and both pressure tested to assure water tightness.

C. Sewer Relation to Other Utilities

In addition to the requirements in Section 022210, Subsurface Obstructions and the above, and other requirements of these specifications, there shall be at least a vertical separation with other utilities or obstructions of three (3) inches. Approved granular material such as crushed stone, sand, etc. shall be placed between the two objects, unless the ENGINEER specifies concrete encasement. If the required three (3) inches cannot be attained, the ENGINEER shall be notified.

D. Bedding, Pipe Zone Material

The pipe zone is defined as extending vertically from the trench bottom to a minimum height as shown on the Contract Drawings above the top of pipe bell. It contains the bedding material and the pipe zone backfill; above it is the general backfill.

In general, pipe zone bedding material shall be placed a minimum of six (6) inches under the pipe and twelve (12) inches over the pipe for the full width of trench. Pipe zone bedding material shall be graded #1 and #2 stone (in conformance with Section 022210 of these specifications) and shall be approved by the ENGINEER. Bedding material shall be placed and well compacted in a minimum bedding depth of six (6) inch below the pipe and 12 inches above the pipe.

Select granular fill will then be placed to the height shown on the Contract Drawings above the pipe bell or as directed by the ENGINEER. The pipe zone backfill material shall be placed and well compacted in 8-inch lifts.

General backfilling and compaction above the pipe zone backfill shall be in accordance with Section 022210 of these specifications.

E. Pipe Laying: Force Mains

Trenching and backfilling shall be performed in accordance with the applicable provisions of Section 022210 of these specifications.

In general, the trench bottom shall be shaped to give uniform support to the lower one-third (or ½) of the pipe. All adjustments to grade shall be made by hand-scraping or hand-filling and thorough tamping under the body of the pipe to prevent subsequent movement.

If the maximum width of the trench (as specified or shown on the plans) is exceeded for any reason except by order of the ENGINEER, the CONTRACTOR shall, at his own expense, install concrete cradle (or other bedding as may be required by the ENGINEER) to properly support the pipe being installed.

The CONTRACTOR shall utilize proper and suitable equipment, tools, and appliances for the safe and convenient handling and installation of the pipe. Care shall be taken not to damage the pipe or pipe lining.

Immediately prior to placing each pipe or fitting in the trench, the portions to be joined shall be carefully examined for defects. Pipe, collars, and gaskets shall be cleaned of all dirt and foreign material. Lubricants, glues, or bolts required for the pipe being installed shall then be applied in accordance with the manufacturer's recommendations, and the pipes carefully jointed.

The pipe bedding shall be prepared so that the entire length of the pipe shall be supported. Bell holes, if required for the type of pipe being installed, shall be dug in the bedding to provide the above pipe support and to allow for the proper and thorough preparation and jointing of the pipe. Once the joint has been made, care shall be taken to present deflection of the pipe installed or separation of the joint.

While pipe laying is in progress, the CONTRACTOR shall take all precautions or necessary steps to keep the trench free of water.

Unless permission is specifically granted in writing by the ENGINEER, every joint shall be made up in the trench, and the CONTRACTOR shall not install two or more pipes jointed together at the top of the trench.

When work is suspended for the night or for any other reason, the open ends of the pipe, fittings, etc. shall be thoroughly sealed, with an approved type of plug for the pipe being installed, to prevent the entrance of soil or foreign materials. Dead ends of pipe, unused branches of trees, crosses, wyes, and valves, etc. shall be sealed with plugs or caps suitable to the type of pipe being used, so that the pipe can be tested (as specified further on in this section).

Pipe alignment, for gravity sewers between manholes, shall be such as to show a full circle of light when being examined from either end.

Force mains shall be laid to the alignment shown on the contract plans. Dips and high points in the vertical alignment of the pipe will not be allowed, unless the terrain requires a cover over the pipe exceeding eight (8) feet.

F. Defective Sewers

If it is found, during the testing and/or inspection of the sewers installed, that a pipe is broken, cracked, settled, or sheared within twenty-five (25) feet of any manhole, the CONTRACTOR shall effect the repair as follows: the existing sewer pipe shall be removed (from the manhole to the next good joint beyond the defective segment), and new sewer pipe shall be reinstalled from the good joint back into the manhole, in a manner approved by the ENGINEER.
If a broken, cracked, or sheared pipe is found beyond twenty-five (25) feet of a manhole, the sewer shall be excavated and repaired at that point, in a manner approved by the ENGINEER.

The costs involved in repairing the above (or any other defects found) shall be done at the CONTRACTOR's own cost and expense, and no additional monies will be allowed for same.

G. Concrete in Sewer or Water main Trenches

Wherever shown on the plans or deemed necessary by the ENGINEER for protection of the sewer or water pipe, the CONTRACTOR shall install concrete cradle under (or concrete encasement around) the sewer pipe.
Unless otherwise shown on the drawings or directed by the ENGINEER, concrete cradle shall be a minimum depth of six (6") inches under the barrel of the pipe and a minimum width of six (6") inches - measured horizontally from the outside of the pipe bell at the spring line. Concrete cradle shall be placed to the spring line of the pipe, in accordance with the above dimensions.

Concrete encasement shall be defined as a complete covering under, over, and around the pipe. Minimum depth and width shall be as described above, and depth over the pipe bell or barrel shall be a minimum of six (6") inches, unless other depths and widths are shown on the contract drawings.

Concrete for cradle or encasement shall be Class B (2500 psi) unless otherwise called for on the contract plans.

For pay purposes, concrete used to support pipe stubs or pipe at manholes or concrete used in manholes shall not be considered as concrete in sewer or water main trenches.

H. 4" and 6" Sanitary Sewer Lines

4" and 6" lines shall be connected to the sewer main by means of a wye, tee, or saddle fitting, with the branch being the same size as the new service line. The fittings shall be elevated as directed, and one-eighth bends shall be used to connect the service line to the fitting as shown on the Plans. The typical house service details on the Contract Plans show the manner in which services are connected for normal-depth sewers. New service lines shall be installed to the property line, or as directed by the ENGINEER, and securely plugged. A 2x4 (inch) creosoted stake (projecting a minimum of two (2) feet above finished grade) shall be securely placed at the end of each service line.

Plugged service fittings shall be installed where directed. Plugs shall be compatible with the type of fitting installed and capable of passing the hydraulic and/or air testing requirements for sewers.

House services shall be installed at a minimum slope of one (1) percent (1/8 inch per foot), unless otherwise directed by the ENGINEER.

The distance between external cleanouts (and between a cleanout and the end of the pipe) in a sewer lateral shall not be more than 100 feet.

3.03 INSPECTION AND TESTING

A. Inspection and Testing

All gravity sewers shall be tested by the Low Pressure Air Test Method in accordance with "Uni-Bell's" Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe (UNI-B-6). This method of testing shall apply to all pipe materials and pipe diameters.

In addition, if the air test on a section of sewer is marginal (as to passing), the ENGINEER can order a corroborative hydrostatic test on the section in question.

Flexible sewer pipe, such as PVC, shall also be subject to deflection testing, as described further on in this section. Costs for all types of testing shall be incorporated in the unit price bid for the pipe.

1. Direct Measure of Infiltration

   N/A

2. Direct Measure of Exfiltration

   Manholes and piping shall be hydrostatically tested. A tolerance of less than 1 inch of water lost per manhole per 24 hours will be accepted.

3. Low Pressure Air Testing

Test pressure method (1 psi or 0.5 psi) shall be determined by the ENGINEER. Standard practice is to use the 1 psi test method.

Air testing for acceptance shall not be performed until the backfilling has been completed.

All sections of pipelines shall be cleaned and flushed prior to testing.

When groundwater is present the average test pressure of 3 psig shall be above any back pressure due to the groundwater level.

The maximum pressure allowed under any condition in air testing shall be 10 psig. The maximum groundwater level for air testing is 13 feet above the top of the pipe.

The equipment required for air testing shall be furnished by the CONTRACTOR and shall include the necessary compressor, valves and gauges to allow for the monitoring of the pressure, release of pressure and a separate test gauge.

The test gauge shall be sized to allow for the measuring of the one psig loss allowed during the test period and shall be on a separate line to the test section.

Air shall be supplied slowly to the plugged pipe segment until the internal air pressure reaches 4.0 psi greater than the average back pressure of any groundwater that may submerge the pipe. Pressure shall not exceed 9.0 psi. At least two minutes shall be allowed for temperature stabilization before proceeding further. Once the pressure has stabilized between 4.0 psi and 3.5-psi timing shall commence.

The pipeline shall be considered acceptable if the time interval for the 1.0-psi pressure drop is not less than the holding time listed in the Air Test Tables on the following pages.

Air testing shall be no sooner than two weeks after the installation of the sewer mains, nor one week prior to pavement restoration over the sewers, except as approved by the ENGINEER in writing.

Areas that are extremely wet (which require wellpointing for the proper installation of sewers) shall be air tested before the dewatering operations are terminated.

The sewers shall be left clean and free from lumps, protruding joint material, etc. and be ready for use. Each section of sewer between manholes shall show, from either end, a full circle of light.

All tests shall be made by the CONTRACTOR, in the presence of the ENGINEER. The expense of the above tests shall be borne by the CONTRACTOR and be included in the unit prices bid for the sewer, under each respective size and depth of cut.

If, after tests have been conducted and accepted, the pipe has been disturbed or broken, or any damage to the pipe is suspected, the ENGINEER may require additional testing to be

conducted at the expense of the CONTRACTOR. Consequently, pipe shall be cleaned before the final testing is conducted.

4. Air Test Table

Based on equations from Uni-Bell's Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe (UNI-B-6):

AIR TEST TABLE I

SPECIFICATION TIME REQUIRED FOR A **1.0 PSIG PRESSURE DROP**
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	6l:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21:366 L	35:37	53:25	71:13	89:02	106.50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

AIR TEST TABLE II

SPECIFICATION TIME REQUIRED FOR A **0.5 PSIG PRESSURE DROP**
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter (in)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2:671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

A. The CONTRACTOR shall exercise care when transporting, handling and placing PVC pipe and fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

B. Ropes, fabric or rubber-protected slings and straps shall be used as necessary when handling PVC pipe. Slings, straps, etc. shall not be positioned at joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

C. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Under no circumstances shall pipe or fittings be dragged over sharp and cutting objects.

D. PVC pipe shall be stored on clean level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports. The pipes should be stored out of direct sunlight.

E. The maximum allowable depth of cuts, gouges or scratches on the exterior surface of PVC pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. Sections of pipe with excessive cuts, gouges or scratches shall be removed and the ends of the pipe rejoined at no cost to the OWNER.

END OF SECTION

SECTION 029250
VEGETATIVE MEASURES FOR EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals required to provide vegetative measures for erosion and sediment control. Work will include applying fertilizer, applying seed and mulch and maintaining all seeded areas as specified herein and as shown on the Drawings.

B. The work shall include fertilizing, seeding and mulching for those areas shown on the Drawings and all areas disturbed by the Contractor. This Specification assumes that the method of seeding will be hydroseed. Alternative methods of seeding may be used based on prior approval of the Owner.

C. Contractor's schedule for seeding and mulching shall be sequenced such that seeding is completed in time to provide maximum growth during this construction season.

1.02 REFERENCE STANDARDS

A. All work for this section shall be performed in strict accordance with "New York State Standards and Specifications for Erosion and Sediment Control", NYSDEC, August 2005 or most recent edition, (i.e., Standards). The Standards are incorporated herein by reference.

1.03 SUBMITTALS

A. Topsoil borrow source name/address and pre-qualification analysis, if off-site material is required.
B. Manufacturer's Certificate of Compliance for seed and fertilizer mixtures
C. Procedure for applying vegetative stabilization
D. Wood cellulose fiber contents and manufacturer name
E. Seeding and Fertilizing Schedule

PART 2 PRODUCTS

2.01 MATERIALS

A. Off-Site Topsoil

1. Topsoil shall be of high quality containing approximately 1/3 humus, 1/3 sand and 1/3 loam.
2. Topsoil shall have at least 20 percent fine textured material (passing the No. 200 sieve) and not more than 15 percent clay.
3. Topsoil treated with soil sterilants, pesticides, insecticides or herbicides shall not be used.
4. Topsoil shall be relatively free of stones over 1-1/2 inches diameter, trash, noxious weeds such as nutsedge and quackgrass, and will have less than 10 percent gravel by volume.
5. Topsoil containing soluble salts greater than 500 ppm shall not be used.
6. Furnished topsoil shall be fertile, friable, natural topsoil typical of the topsoil of the locality, and shall be obtained from a well-drained site that is free of flooding and from which no topsoil has previously been stripped. The area from which topsoil is to be taken shall possess such uniformity of soil, depth, color, and other characteristics to offer assurance that when

removed in commercial quantities that the soil shall be homogeneous in nature and shall meet the requirements of this Section. Topsoil shall not be delivered to the site or used while in a frozen or muddy condition. Topsoil as delivered to the site shall have a pH between 6.0 and 7.6. Lime shall be applied and incorporated with the topsoil as indicated by testing and as directed by the Owner before the topsoil is delivered to the working area.

B. Fertilizer

1. Fertilizer shall be standard commercial grade fertilizer meeting the requirements of all State and Federal regulations and standards of the Association of Office Agricultural Chemists. Fertilizer shall be delivered to the site in original, properly labeled, unopened, clean, containers each showing the manufacturer's guaranteed analysis conforming to applicable fertilizer regulations and standards. Fertilizer shall be 10-10-10, unless otherwise approved by the Owner or specified in the Contract Documents.

C. Seed

1. Seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act and applicable State seed laws. Seed shall be furnished in sealed bags or containers bearing the date of the last germination, which date shall be within a period of 6 months prior to commencement of seeding operations. No seed shall be used unless properly labeled and no seed shall be used after its date of expiration. Seed shall be from same or from the previous year's crop; each variety of seed shall have a purity of not less than 85%, a percentage of germination not less than 80%, shall have a weed seed content of not more than 1% and contain no noxious weeds. The above percentages are by weight.
2. Except where noted on plans, the seed shall be furnished and delivered premixed pursuant to the Mix # 6 in the “New York State Standards and Specifications for Erosion and Sediment Control” (NYSDEC, August 2005 or most recent edition) specification for Permanent Critical Area Plantings or other applicable seed mixture specified in the NYSDEC “Permanent Critical Area Plantings” specification. A manufacturer's certificate of compliance to the specified mixes shall be submitted by the manufacturer for each seed mix. These certificates shall include the guaranteed percentages of purity for each type of seed in the mix, weed content, and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.

D. Mulch

1. Mulch shall comply with the “New York State Standards and Specifications for Erosion and Sediment Control” (NYSDEC, most recent edition) specification for Mulching.
2. Mulches shall not contain sticks larger than 1/4-inch diameter or other materials that could prevent matting during application. No mulch shall be used within 48 hours after cutting. Mulch shall be free from mold and other objectionable material and shall be in an air-dry condition suitable for placing with mulch blower equipment.
3. Wood fiber mulch for anchoring shall be wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber shall contain a green dye that will provide easy visual inspection for uniformity of the slurry spread. The wood cellulose fiber, including dye, shall contain no growth or germination-inhibiting properties. It shall be manufactured in such a manner that, after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous material. When sprayed over straw mulch, the material shall allow absorption and percolation of moisture. The manufacturer shall submit a certificate that the wood cellulose fiber meets the following requirements:

Quantity	Specification Limit
Particle Length	0.375 inch maximum
Particle Thickness	0.047 inch maximum
Net Dry Weight Content	minimum stated on bag
pH	4.0 to 8.5

Quantity	Specification Limit
Ash Content	1.6% maximum
Water Holding Capacity	90% minimum

The material shall be delivered in packages of uniform weight and bear the name of the manufacturer, the net weight, and a supplemental statement of net weight content.

4. Alternative mulches and anchoring materials meeting the requirements of the New York Standards and Specifications are acceptable, subject to approval by the Owner.

PART 3 EXECUTION

3.01 APPLICATION

A. For all areas to be permanently seeded, the following steps shall be implemented.

1. Topsoil shall be applied as specified in 3.02(A), below.
2. Fertilizer shall be applied at a minimum rate of 600 pounds per acre. Fertilizer shall be disced into topsoil surfaces to a depth of 3 to 5 inches.
3. Mulch will be applied at a rates specified in the "New York State Standards and Specifications for Erosion and Sediment Control" (NYSDEC, August 2005 or most recent edition) specification for Mulching. Also, lime will be applied, if needed, at the rates determined by the Owner based on results of soils tests.
4. As an alternative to seeding and mulching, hydroseeding may be performed using mixture of seed/fertilizer (at previously defined application rates) and wood fiber cellulose (at a rate of 2000 pounds per acre). The wood cellulose fiber shall be mixed with water at a maximum rate of 50 pounds of wood cellulose fiber per 100 gallons. The Contractor is responsible for cleaning all structures and paved areas of unwanted deposits of the hydroseed mixture.

B. For all areas to be temporarily seeded, the same steps shall be implemented except that neither topsoil nor fertilizer shall be used, unless otherwise approved by the Engineer.

3.02 INSTALLATION

A. Where topsoil is required, it shall be applied as follows.

1. The Contractor shall maintain previously established elevations and grades, as shown on the Drawings in a true and even condition.

2. The subgrade shall be raked and all rubbish, sticks, roots, and stones larger than 6 inches shall
be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with topsoil. Before placement of topsoil, all construction work in the

immediate area shall have been completed.

3. Topsoil shall be uniformly placed over approved areas and lightly rolled. No topsoil shall be spread in water or while frozen or muddy.

4. Lime shall be applied to topsoil in a preparation area at the rates indicated by soil testing to bring the topsoil pH to a range of 6.0 to 7.6. Lime may not be mixed with fertilizer for application Lime shall be mixed/spread evenly throughout the topsoil.

5. After topsoil has been spread, it shall be carefully prepared by scarifying or harrowing and hand raking. All stiff clods, lumps, roots, litter and other foreign material shall be removed from the area and disposed of by the Contractor. During the preparation efforts, all depressions caused by settlement or debris removal voids shall be filled with additional topsoil and the surface shall be regraded until a smooth and even finished grade is created.

6. The Contractor shall maintain the specified depth of topsoil from the time it is placed until seeding and securing of the mulch are completed.

B. No seeding shall be done on frozen ground or when the temperature is 32ºF or lower. Schedules for seeding and fertilizing must be submitted to the Owner for approval prior to beginning the work. Seeding shall be done within twenty-four hours following soil preparation. Mulch materials shall be applied on seeded areas immediately after seeding.

C. Before seeding, all gullies, washes, or disturbed areas that develop subsequent to final dressing of topsoil shall be repaired. All areas shall be loosened by discing, harrowing, or other approved methods immediately prior to seeding. For areas flatter than 3 horizontal:1 vertical (3:1), the topsoil shall be loosened to a depth of 3 inches. For areas 3:1 and steeper, the topsoil shall be loosened to a depth of 1 inch.

D. In order to prevent unnecessary erosion of newly topsoiled and graded slopes and unnecessary siltation of drainage ways, the Contractor shall develop a seeding schedule such that temporary or permanent seeding and mulching in disturbed areas that are not under active excavation will completed as soon as practicable in areas of the site where stabilization has temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, unless earth-disturbing activities will be resumed within twenty-one days. Exceptions include slopes greater than 10 percent and wetland areas, which will be stabilized within one-work day following cessation of activity. When protection of newly topsoiled and graded areas is necessary at a time which is outside of the normal seeding seasons, the Contractor shall protect those areas by whatever means necessary, as approved by the Owner, and shall be responsible for prevention of siltation in the areas beyond the limit of work.

E. All utility line trenches will be backfilled at the end of each workday.

3.03 MAINTENANCE, AND PROVISIONAL ACCEPTANCE

A. The Contractor shall keep all seeded areas watered and in good condition, reseeding all seeded areas if and when necessary until a good, healthy, uniform growth is established over the entire area seeded. The Contractor shall maintain all temporarily seeded areas in an approved condition throughout the project and shall maintain permanently seeded areas for a period of one calendar year after the date of Owner's acceptance of the work.

B. The permanently seeded and fertilizer areas will be inspected to verify that the grass has successfully been established based on the following criteria.

1. No bare spots exist larger than one square foot.
2. No more than 5 percent of total area has bare spots.
3. Any areas not meeting these criteria shall be reseeded and/or refertilized by the Contractor at no extra cost to the Owner until all seeded areas meet these criteria.

END OF SECTION

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SECTION 029310
STRUCTURAL MEASURES FOR EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals required to provide structural measures for erosion and sediment control during and upon completion of construction as specified herein and as shown on the Drawings.

B. The work shall include construction and maintenance of temporary and permanent erosion control structures for those areas shown on the Drawings and all areas disturbed by the Contractor. The work will include, but is not necessarily limited to installation and maintenance of the following structural measures:

1. silt fencing
2. stone check dams
3. culvert inlet protection
4. Erosion control blankets (temporary and permanent)
5. stone & block drop inlet protection
6. curb drop inlet protection
7. grate filters (inlet)
8. HDPE culvert inlet protection
9. Combo silt fence/check dam inlet protection

C. Contractor is responsible to control all run-off from the work areas in a manner consist with Section 01560

1.02 REFERENCE STANDARDS

A. All work for this section shall be performed in strict accordance with "New York State Standards and Specifications for Erosion and Sediment Control", NYSDEC, August 2005 or most recent edition, (i.e., Standards). The Standards are incorporated herein by reference.

B. Selected materials specified in Section 2.01 below shall meet the material requirements of the "New York State Standards and Specifications for Erosion and Sediment Control", NYSDEC, August 2005 or most recent edition.

PART 2 PRODUCTS

2.01 MATERIALS

A. Silt Fence Fabric

1. Silt fence fabric shall be woven and consist of monofilaments of polypropylene treated with ultraviolet light stabilizers. The fabric shall have sleeves through which either steel or 2-inch square wood posts can be inserted.
2. Silt fence fabric shall be inert to chemicals commonly found in soils and to hydrocarbons.
3. Silt fence fabric shall be resistant to mildew, rot, insects, and rodent attack.
4. Silt fence fabric shall conform to the following test criteria:

Property	Unit	Test Method	Minimum Accepted Value
Grab Strength	lbs	ASTM D 1682	90
Elongation at Failure	%	ASTM D 1682	50 (max.)
Mullen Burst Strength	psi	ASTM D 3786	200 (min)
AOS	U.S. Sieve No.	ASTM D 4751	60 - 80
Ultraviolet Stability	%	ASTM D 4355	90
Puncture Strength	lbs	ASTM D 4833	100
Slurry Flow Rate	gal/min/sq.ft	ASTM D 4151	0.3

B. Silt Fence Posts

1. Wood shall be composed of sound quality hardwood with a minimal cross section area of 3.0 square inches.
2. Wood posts shall be a minimum of 36 inches.
3. Steel posts shall be standard T & V section weighing not less than 1.00 pound/linear foot.

C. Check Dams

1. Height shall not greater than two (2) feet. Center shall be maintained nine (9) inches lower than abutments at natural ground elevation.
2. The check dams shall be spaced as necessary in the channel so that the crest of the downstream dam is at the elevation of the toe of the upstream dam.
3. Stone Size : use graded stone 2 to 15 inches in size. NYSDOT Light Stone Fill meets these requirements.

D. Erosion Control Blankets

1. Temporary biodegradable erosion control blankets for slopes 1:1 and greater shall be North American Green C125BN or equivalent or as specified in the Stormwater Pollution Prevention Plan
2. Temporary biodegradable erosion control blankets for slopes 3:1 and 2:1 shall be North American Green S150 or equivalent or as specified in the Stormwater Pollution Prevention Plan.

E. Inlet Protection
1. Refer to Appendix E on standard and specifications.

2.02 QUALITY CONTROL

A. Contractor shall provide manufacturer's certificates for Silt Fence.

PART 3 EXECUTION

3.01 SILT FENCE

A. Silt fence shall be installed as shown on the Drawings, in the locations shown on the Drawings and down slope of any area before disturbance by construction activities. As shown on the Drawings, the silt fence fabric panels shall be installed loosely with adjacent panels overlapped a minimum of 12 inches. Silt fence material shall be embedded at least 6 in. beneath ground surface and shall extend upward at least 16 in. above the disturbed area ground surface. The top edge of the fabric shall be reinforced or shall have a 1 inch tuck.

B. Accumulated silt and debris shall be removed by the Contractor from behind the face of the silt fence when the silt deposits reach approximately one third the height of the fence. Clogged or damaged fabric shall be immediately replaced.

3.02 CHECK DAM MAINTENANCE

A. The check dams should be inspected after each runoff event. Correct all damage immediately. If significant erosion has occurred between structures a liner of stone or other suitable material should be installed in that portion of the channel.

B. Remove sediment accumulated behind dam as needed to allow channel to drain though the stone check dam and prevent large flows from carrying sediment over the dam, replace stones as needed to maintain the design cross section of the structures.

3.03 EROSION CONTROL BLANKETS

A. Installed pursuant to manufactures recommendations.

3.04 INLET PROTECTION

A. The inlet protection structure should be inspected after each runoff event. Correct all damage immediately.

B. Remove sediment accumulated behind the inlet protection structure as needed. Replace stones as needed. Check materials for proper anchorage and secure as necessary.

3.06 PROVISIONS FOR EROSION CONTROL DURING CONSTRUCTION

A. Contractor shall implement erosion control measures around all areas to be disturbed prior to disturbing ground in the area, to the satisfaction of the Owner. The Engineer will routinely inspect erosion control structures to confirm that Contractor is maintaining these features.

B. The Contractor shall take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, wastes, fuels, oils, bitumens, and calcium chloride into surface waters. Special precautions shall be taken in the use of construction equipment to prevent operations that promote erosion.

C. The temporary drainage ditches, silt fences, and other erosion and sedimentation control features shall be maintained in the locations shown on the Drawings and at other incidental locations identified by the Owner or Engineer.

D. Disposal of drainage from the site shall be at a location approved by the Owner. Under no circumstances whatsoever shall drainage be pumped, discharged, or otherwise allowed to leave the site until silt and other sedimentary materials have been removed according to the erosion and sediment control measures described in these specifications. Particular care shall be taken to prevent the discharge of unsuitable drainage to wetland areas.

END OF SECTION

SECTION 029500
DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION

A. This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

1.2 RELATED SECTIONS

A. Section 022210 – Trenching and Excavation
B. Section 022240 – Rock Excavation

1.3 SUMMARY

A. The work to be completed by the CONTRACTOR includes, but is not necessarily limited to the following:
    1. Dewater excavations, including seepage and precipitation.
B. The CONTRACTOR shall be responsible for providing all materials, equipment, labor, and services necessary for management of water and erosion control. Excavation work shall not begin before any erosion and sediment controls and/or SWPPP, if required, has been in place.

1.4 SUBMITTALS

A. The CONTRACTOR shall submit the discharge locations from all dewatering operations and the method to ensure turbid free runoff to any receiving water course or water body.

1.5 REQUIREMENT

A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 1 foot or AOBE below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.
B. Dewatering Plan with comply with all recommendations outlined in the Geotechnical Report, a copy of which is included in the Contract Documents.
D. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 1 foot or AOBE below prevailing excavation surface.
E. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
F. Maintain stability of sides and bottom of excavation.
G. Construction operations are performed in the dry.
H. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
    1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where

underlying materials are not free draining or are subject to swelling or freeze-thaw action.
2. Erosion is controlled.
3. Flooding of excavations or damage to structures does not occur.
4. Surface water drains away from excavations.
5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

I. Contractor shall protect the Owner's storm sewers at all times and shall clean debris and repair any damage that occurs.

J. Permitting Requirements: The contractor shall comply with all applicable Federal, State and County rules and regulations where the work is performed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 INSTALLATION

A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.

B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 1 foot or AOBE below prevailing excavation surface at all times.

3.2 OPERATION

A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL

A. Dispose of water removed from the excavations in accordance with all applicable NYSDEC requirements and as follows:
1. Will not endanger portions of work under construction or completed.
2. Will cause no inconvenience to others working near site.
3. Will comply with the stipulations of required permits for disposal of water.
4. Will Control Runoff: The CONTRACTOR shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The CONTRACTOR shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits and SWPPP, if required.

a. Any turbid discharges from dewatering areas will be directed to either a settling tank or a stable, level, grassed area, at least 100 feet from watercourses and wetlands. If the discharge is directed to a stable, level vegetated area, the discharge and any related dewatering filter area will be surrounded by a silt curtain sediment barrier. Settling tanks and dewatering filter devices shall be of sufficient capacity to handle the discharge of the pumps such that the water returned to a stream is clear.
b. No sewer pipes or manholes shall be used as dewatering and discharging devices without approval of the Engineer.
c. The contractor will identify prior to the start of construction, discharge locations from all dewatering operations and the method to ensure turbid free runoff to any receiving water course or water body.

B. Excavation Dewatering:
1. The CONTRACTOR shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
4. The CONTRACTOR shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT

A. Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION

A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by CONTRACTOR, at no additional cost to OWNER.

3.6 DAMAGES

A. Immediately repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION

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SECTION 029840
SITE RESTORATION AND LANDSCAPING

PART 1. GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall be responsible for the complete restoration of all areas affected by the construction operations.

B. Work performed under this section shall include the furnishing of all labor, tools, equipment and materials necessary to completely restore all public and private property - in all areas disturbed by construction, and in other special areas of the project as may be designated by the ENGINEER or as shown on the plans - to a condition which is equal to or better than what existed prior to start of the contract. Incident restoration work includes, but is not limited to the following: signs-public or private, fencing poles, trees, shrubs and bushes, lawns and gardens, public and private utilities, drainage structures and ditches, retaining walls, foundation, slabs, dams and embankment ponds and similar water bodies.

1.02 QUALITY ASSURANCE

A. CONTRACTOR shall take a complete set of photographs of all work areas prior to commencing work as required by the Supplemental General Requirements. CONTRACTOR shall supply the ENGINEER with one set of these photographs for documentation purposes including but not limited to restoration work.

B. The contractor shall provide the ENGINEER with documentation that all material required under this item conforms to contract requirements. The contractor shall provide test results for the topsoil, tickets for seed mix, etc.

1.03 SUBMITTALS

A. Preconstruction photographs submitted per Supplemental General Requirements.

B. Documentation and test results for the topsoil, seed mix, lime, and fertilizer that demonstrate conformity with this specification section.

PART 2. PRODUCTS

2.01 MATERIALS

A. In general, all existing materials removed or disturbed during construction shall be replaced with new materials of the same quantity as those disturbed during construction.

B. Where existing materials or structures can be reused, such as signs, fencing, etc., the contractor shall carefully remove and replace the existing structures to the satisfaction of the individual owner, utility, and ENGINEER.

C. Where materials are encountered that are no longer made and cannot be replaced with materials of similar quality, the contractor shall make every effort to preserve and reuse the existing materials.

2.02 TOPSOIL, PLANTINGS AND SEEDINGS

A. Topsoil shall be of high quality containing approximately 1/3 humus, 1/3 sand and 1/3 loam. Topsoil shall be uniform and homogenous in composition and shall have a pH range of 6.0 to 7.6.

B. Lime shall be agricultural limestone containing at least 88% calcium and magnesium carbonates and shall be obtained from quality manufacturers.

C. Fertilizer shall be standard 10-10-10 fertilizer. Mulch shall be hay or straw free from noxious weeds.

D. Replacement shrubbery shall be vigorous stock obtained from a reputable nursery of a size and shape to match existing. All replacement shrubbery shall be balled in burlap.

E. Seed mix for lawns shall be as follows:
1. 60% Kentucky Blue Grass
2. 20% Redtop
3. 20% Perennial Ryegrass

F. Seed mix for open or wooded areas with slopes of less than one on three shall be as follows:
1. 60% Red Fescue
2. 15% Kentucky Bluegrass
3. 20% Perennial Ryegrass
4. 5% White Clover

G. Seed mix for open or wooded areas with slopes greater than one on three shall be as follows:
1. 30% Crown Vetch
2. 70% Perennial Ryegrass

H. Seed mix for stream banks and drainage swales shall be as follows
1. Tall Fescue (0.5 lbs/1000 square feet)
2. Creeping Red Fescue (0.5 lbs/1000 square feet)
3. Red Top (0.1 lbs per 1000 square feet)

I. Temporary Seeding Mixture IF: Spring or summer or early fall, then seed the area with ryegrass (annual or perennial) at 30 lbs. per acre (Approximately 0.7 lb./1000 sq. ft. or use 1 lb./1000 sq. ft.). IF: Late fall or early winter, then seed Certified 'Aroostook' winter rye (cereal rye) at 100 lbs. per acre (2.5lbs./1000 sq. ft.).

J. Hydroseeding will be required but shall be as approved by the OWNER and ENGINEER.

PART 3. EXECUTION

3.01 INSTALLATION OF RESTORATION WORK

A. Structures and plantings to be restored after completion of final grading shall be done in conformance with generally accepted practices skilled in the specific trade, equipment which is properly sized and designed to accomplish the specific task and scheduled to cause the least inconvenience and disruption to the property owner.

B. CONTRACTOR shall be responsible for completing temporary stabilization to prevent erosion. Such temporary measures shall be included in the lump sum price for this item.

C. CONTRACTOR is responsible for establishing vegetation on disturbed areas. To accomplish this, CONTRACTOR shall re-seed or replant as necessary and provide fertilizers, lime, or additional soil amendments as may be needed to complete restoration.

D. All final graded areas shall be approved by the ENGINEER prior to the initiation of the restoration activities.

E. Seeding shall not be completed after October 15th without approval of the ENGINEER.

F. As work proceeds and prior to seeding, CONTRACTOR shall remove all exposed stones and debris greater than 2 inches from surface of area to be seeded.

G. Surface structures, which have been removed, shall be regraded with the appropriate backfill material, compacted and properly prepared for the new surface.

H. Ditch lines shall be regraded and shaped generally to match existing and to provide proper drainage.

I. Cleaning Up - After final restoration is complete, the contractor shall remove all excess excavated material, rubbish and debris all work areas and grass plots; and the whole shall be left in a neat and acceptable condition.

3.02 RESTORATION OF LAWN AREAS

A. Lawn areas shall be graded to a depth of 6 inches below existing; removing all rocks, stones or stumps and the subsoil shall be scarified. CONTRACTOR shall supply and place six inches of topsoil over the subsoil so that no ridges or depressions occur. Topsoil shall be hand raked as necessary to blend with existing grades. CONTRACTOR shall provide hydroseeding for all lawn areas. CONTRACTOR shall care for reseeded areas until final payment is made and until the lawn has reestablished itself.

B. For slopes greater than approximately 10%, contractor shall supply and place erosion control fabric to aid in establishing grass. Fabric shall be completely bio-degradable within 2-years and shall be placed according to supplier specifications. CONTRACTOR shall include up to 5000 square feet of such mat for placement on site AOBE.

3.03 RESTORATION OF OPEN AND WOODED AREAS

A. Open or wooded areas shall be graded to the grades existing prior to disturbance, fertilized at a rate of 1,500 pounds per acre, limed at a rate of 2,000 pounds per acre, seeded at 70 pounds per acre, and mulched in the same manner as lawn areas. Topsoil will only be required if exceptionally barren soil is encountered.

B. Sloped areas shall be prepared in the same manner as open or wooded areas using the seed specified for sloped areas.

C. Shrubbery shall be planted in a pit at least 1-1/2 times the size of the root ball. Backfill for shrubbery shall consist of topsoil, peat moss, and fertilizer in the ratio of 7:1:1/4. All shrubbery shall be watered at the time of planting.

3.04 PLANTING OF TREES SHRUBS AND VINES

A. Plant Protection:
Prior to delivery, the trunk, branches, and foliage of the plants shall be sprayed with non-toxic antidesicant, applied according to the manufacturer's recommendations. This does not apply to state nursery seedlings.

B. Planting Time:
Deciduous trees and shrubs: April 1 to June 1 and October 15 to December 15.
Evergreen trees and shrubs: April 1 to June 1 and September 1 to November 15.
All planting of trees and shrubs shall be planted within these dates.

C. Spacing:
Plant all trees and shrubs well back from buildings to allow for mature crown size. The following are guides for planning:
Large trees: 50-60 feet apart.

Small trees: 20-30 feet apart Columnar species: 6-8 feet apart
Hedges: 1-4 feet apart
Shrubs: For clumps, plan spacing so mature shrubs will be touching or overlapping by only 1 or 2 feet.

D. Site Preparation:
1. Individual sites for planting seedlings can be prepared by scalping the sod away from a four foot square area where the seedling is to be planted.
2. All planting beds shall be cultivated to a depth of 8 inches, or chemically treated for weed control. Remove objectionable objects that will interfere with maintenance of site.

E. Planting:
1. Plants shall be located as shown on plans and/or drawings and, where necessary, located on the site by stakes, flags or other means.
2. The plants shall be set upright in holes.
3. All plants shall be thoroughly watered on the same day of planting. Plants that have settled shall be reset to grade.

F. Wrapping:
Immediately after planting, wrap deciduous tree trunks from the bottom to the first limb with a 4 inch wide bituminous impregnated, insect resistant tape or paper manufactured for that purpose. Tie with jute (bag strings) at top and bottom.

G. Mulching:
Mulch the disturbed area around individual trees and shrubs with a 4-inch layer of wood chips. Pull woodchips 1 inch away from the base of shrubs to avoid fungus development.

3.05 MOWING

CONTRACTOR shall perform one mowing of all areas restored under the project AOBE.

END OF SECTION