

SECTION 02350 - TREE PROTECTION AND ROOT PRUNING

PART 1 GENERAL

1.1 SUMMARY

- A. This item shall consist of furnishing all labor, materials, tools and equipment required to protect those trees designated to remain on the site. Protection of designated trees shall include directing heavy construction work activity away from the protected trees Section Includes the protection, trimming, and pruning of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.
- B. Related Sections:
 - 1. Section - 02920 Lawns and Grasses
 - 2. Section – 02930 Exterior Planting
 - 3. Section - 02941 Planting Soils
 - 4. Section - 02410 Air Spading

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Tree Pruning Schedule: Written schedule from certified arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
- C. Qualification Data: For tree service firm and arborist, ISA certification required.
- D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly pruned and repaired when damaged.
- E. Maintenance Recommendations: From certified arborist, for care and protection of trees affected by construction during and after completion of the Work.
- F. Provide final log of work performed including any damage that occurred during construction and subsequent repairs.

1.3 QUALITY ASSURANCE

- A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site on a full-time basis during execution of the Work.
- B. Arborist qualifications: An arborist certified by the International Society of Arboriculture.
- C. Tree Pruning Standards: Comply with ANSI A300 (Part 1), “Trees, Shrubs, and other Woody Plant Maintenance—Standard Practices (Pruning).”
- D. Pre-installation Conference: Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials for tree/vegetation protection barriers shall conform to the following requirements and AOBES:
 - 1. Mesh Construction Fencing by Conwed or Approved Equal (orange or green color)
 - 2. Cedar Posts (minimum length 6.0 feet)
 - 3. #14 gauge steel wire
- B. Temporary Signs: White or yellow weatherproof material, 8 inch by 40 inch minimum, with 3-inch black letter: text – “Tree Protection Area – Do Not Enter”.

PART 3 EXECUTION

3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing around the tree protection zones designated on the plans or where directed by the engineer to protect remaining vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
- B. Temporary Signs: Install temporary signs 60 feet apart, or two per protected tree, whichever is greater, on posts of temporary fencing. Maintain temporary signs and remove when construction is complete.
- C. Tree Trunk Protection: The Contractor shall provide 2 inches by 8 inches by 8-ft. boards, banded continuously around each trunk to prevent scarring of trees shown on the plans or designated by the Certified Arborist. For multi-stem trees, saplings, and shrubs to be protected within the area of construction, temporary fencing may be used for trunk protection.

The Contractor shall repair or replace any and all damaged plant material determined by the Certified Arborist to any existing or newly installed plant material at its own expense. Unnecessary damage to ground cover or turf shall be repaired or replaced as specified for restoration of similar areas within the plans, or as directed by the Certified Arborist, and shall be at the Contractor's expense.

- D. Root Zone Protection: During the entire construction period all reasonable efforts shall be made to protect from damage those trees and their root system designated to remain. Around the trees to be protected, the Contractor shall avoid excessive excavation or compaction and damage during the removal of trees and shrubs designated to be removed. All plant material designated to be saved, or outside of the limits of construction, shall be protected during subsequent construction work. Work under these items will include construction and maintenance of temporary fencing to protect the root zones of existing trees and other plantings, construction and maintenance of tree trunk protection.

A protection barrier or temporary fence of at least 1.2m (4 feet) in height shall be installed around each tree to be protected and preserved. The tree protection shall be installed prior to the actual construction start and maintained for the duration of the project.

Within this protection zone, construction materials shall not be stored, equipment operated and/or temporary storage buildings or work trailers placed.

The protection barrier shall be constructed of orange snow fencing securely fastened to fence posts spaced a maximum of 1.5 m (5 feet) on center. Posts are 1.8m (6 feet) in length with 60 cm (2 feet) set into the ground and 1.2m (4 feet) extending above ground. The fencing shall be attached to the post with a minimum of four (4) nylon-locking ties evenly placed at each post.

E. Dimensions of the protection barrier are as follows:

1. Trees located in Tree Pits:
 - a. Where trees are located within Tree Pits, the fencing should be installed at a minimum distance of the inside dimension of the Tree Pit opening with one stake at each corner of the opening.
2. Trees Located in Parkways or Boulevards:
 - a. **Small Trees (<9" D.B.H.):** Minimum 1.5m (5 feet) from face of tree along the parkway length. In the dimension bordered by the public sidewalk or curb, the fencing shall be the width of the grass parkway with a maximum offset of 30cm (1 foot) from back of curb or edge of sidewalk. In no case shall the closure be less than 61cm (2 feet) from the centerline of the tree. (Example: 6" Tree in a 6' parkway as measured from back of curb to sidewalk. The dimension of the protection fencing would be 1.2m x 3m (4' x 10') with tree in the center). Note: Larger grass parkways (>12') may allow for a ten-foot by ten foot (10' x 10').
 - b. **Medium (10" to 15" D.B.H.):** Minimum of ten (10) feet from face of tree along the parkway length. In the dimension bordered by the public sidewalk or curb, the fencing shall be the width of the grass parkway with a maximum offset of one (1) foot from back of curb or edge of sidewalk. In no case shall the closure be less than two (2) feet from the centerline of the tree.
 - c. **Large (>15" D.B.H.):** Minimum of fifteen (15) feet from face of tree along the parkway length. In the dimension bordered by the public sidewalk or curb, the fencing shall be the width of the grass parkway with a maximum offset of one (1) foot from back of curb or edge of sidewalk. In no case shall the closure be less than two (2) feet from the centerline of the tree.

The Contractor shall be responsible to protect all trees from damage at the construction site. It shall be the responsibility of the Contractor to restore all damaged parkways to their original condition. Any trees damaged as a result of construction activity as determined by the Certified Arborist shall be repaired, removed and/or replaced at the Contractor's expense. The Contractor shall pay liquidated damages in the amount of the appraised value of the tree(s).

At a minimum, any tree greater than 4" D.B.H. that is permanently damaged due to the construction project and not originally marked for removal shall be replaced with a new tree as identified by the Owner and shall have a minimum of 4" caliper B&B. Any damaged tree smaller than 4" caliper measured 6" above the ground shall be replaced in kind, inch for inch.

- F. Materials shall be disposed of in accordance with specifications.
- G. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- H. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- I. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize shoring or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical; cut roots approximately 3 inches (75 mm) back from new construction.
 - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect
 - 3. Do not allow heavy equipment in tree protection areas. All excavation work is to be performed by hand.
- D. Root Pruning: Do not cut main lateral roots; cut only smaller roots that interfere with installation of utilities or construction. Cut roots with sharp pruning instruments; do not break or chop.
- E. When excavating, place excavated soil on opposite side of trench from tree.

3.3 ROOT PRUNING

- A. Root pruning shall take place only where the roots of existing trees have been damaged by the Contractor during construction of the Project, as directed by the Certified Arborist.
- B. If construction is to occur within the root zone of existing plant material, root pruning and special plant care including fertilizing and watering will be required, as directed by the Certified Arborist and hereinafter specified. Prior to root pruning, remove all weeds growing in existing tree mulch rings. Root pruning using an approved mechanical root pruning saw shall be performed prior to digging where noted on the plans, or directed by the Certified Arborist. Air Spading excavation consisting of hand and/or pneumatic excavation may be required if indicated on plans or as directed by Certified Arborist. Whenever roots of plant material to remain are exposed during construction, the damaged root ends are to be removed by cutting them off cleanly.
- C. Initial watering shall be performed on all trees, which are designated for root pruning. Water trees immediately by thoroughly saturating root balls and provide a horticultural watering bag, such as a Gator Bag or equivalent, filled with water to keep root balls thoroughly saturated during first three weeks following root pruning. Thereafter refill bags as required, according to weather conditions, to keep root balls in a moist condition during growing seasons, through the duration of the Project. Test root balls for optimal moisture once a week using a soil auger.
- D. Contractor shall be responsible for location of all utilities prior to installation of trees. Notification of the local Utilities Alert Network is required for all planting sites.
- E. All pruning shall be overseen by a professional arborist (someone whose principal occupation is the care and maintenance of trees). All pruning shall be done according to the National Arborist Association's Pruning Standards for Shade Trees Class 11 - Standard Pruning Specifications.
- F. Any damage to the root zone, as determined by the Certified Arborist, will be compensated by pruning an equivalent amount of the top vegetative growth of the material within 1 week

following root damage, fertilization and supplemental watering.

- G. Fertilize damaged trees with fertilizer that promotes root growth. Fertilizer nutrients shall be applied within 48 hours after root damage occurs. Fertilizer nutrients shall be applied within 48 hours after root damage occurs. A fertilizer with a 1: 1: 1 ratio shall be applied at the rate of .5 pounds of nutrients per 1000 square feet (2 kg per 90 square meters).
- H. Application shall be accomplished by placing dry fertilizer in holes in the soil. The holes shall be 8 inches (200 mm) to 12 inches (300 mm) deep and spaced 24 inches (600 mm) apart in an area beginning 30 inches (1 meter) from the base of the plant. Holes can be punched with a punch bar, dug with a spade, drilled with an auger or any other method approved by the Certified Arborist.
- I. Approximately 0.02 pounds (10 grams) of fertilizer nutrients shall be placed in each hole 250 holes per 1000 square feet (90 square meters). Fertilizer Nutrients shall not be measured for payment but considered incidental to root pruning. If the Certified Arborist determines that the whole method of fertilizer placement is not practical or desirable, an approved method of uniform surface application will be allowed. Neither separate measurement nor payment will be made for fertilization, but will be considered incidental to the cost of TREE PROTECTION.
- J. Supplemental water shall be applied within 48 hours of any root damage. The water shall be applied at the rate of 7 quarts per square yard of surface area within the root zone of plant material having sustained damage to the root zone. Root zone shall be calculated as the areas, which extend three meters beyond the limits of the crown's branches. Subsequent weekly watering shall be applied if deemed necessary by the Certified Arborist. Neither separate measurement nor payment will be made for supplemental watering but will be considered incidental to the cost of TREE PROTECTION.
- K. The Contractor shall repair or replace any and all damage determined by the Certified Arborist to any existing or newly installed plant material at its own expense. Unnecessary damage to ground cover or turf shall be repaired or replaced as specified for restoration of similar areas within the plans, or as directed by the Certified Arborist, and shall be at the Contractor's expense.
- L. Materials shall be disposed of in accordance with specifications.

3.4 REGRADING

- A. Do not fill within tree protection zones, unless otherwise indicated.
- B. Where filling for new construction is required within drip line of trees, perform work by hand to minimize damage to root systems
 - 1. Where existing grade is below elevation of finish grade, fill with topsoil. Place topsoil by hand in a single uncompacted layer and hand grade to required finish elevations.

3.5 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
- C. Cut branches with sharp pruning instruments; do not break or chop.
 - 1. Clean all pruning instruments with antimicrobial solution between performing work on separate trees to avoid the potential spread of pathogens.
- D. Chip removed tree branches and uses as organic mulch or dispose of off-site.

3.6 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
- B. Remove and replace dead and damaged trees that arborist determines to be incapable of restoring to a normal growth pattern.
 - 1. Provide new trees of a 6-inch caliber size and of a species selected by Architect when damaged trees more than 6-inch caliber size, measured at breast height, are required to be replaced.
 - 2.
 - a. Planting New Trees: Comply with Columbia University standards.
 - b. Warranty and Maintenance Period: One year.
- C. Aerate surface soil, compacted during construction, 10 feet (3 m) beyond drip line. Drill 2-inch (50-mm) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.7 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property. Disposal shall be in a legal manner.

END OF SECTION

SECTION 02370 - TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 Description of Work

- A. The work of this section includes all temporary erosion and sediment control and related and incidental operations, including:
 - 1. Silt fence installation and maintenance
 - 2. Maintenance and repairs of erosion and sediment control measures
 - 3. Rock filters and sediment basins

1.2 Quality Assurance

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction. Construction operations shall be carried out in a manner such that soil erosion, air pollution, and water pollution is minimized. State, County, and Municipal laws concerning pollution abatement shall be followed.
- C. The recommendations and standards set forth in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition.
- D. The Contractor shall take action to remedy unforeseen erosion conditions and to prevent damage to adjacent properties as a result of increased runoff and/or sediment displacement. Stockpiles of wood chips, hay bales, crushed stone, and other mulches shall be held in readiness to deal immediately with emergency problems of erosion. All erosion control checks and structures shall be inspected after heavy rainfalls, and if damaged, repaired or replaced.

PART 2 - PRODUCTS

- 2.1 All materials and products shall meet the approval of the engineer. Cut sheets for all items shall be submitted for review and approval prior to installation.
 - A. Silt Barrier Fence: Class 3 geotextile materials with 2"x2" anchoring pots
 - B. Flow Filter Bag (inlet protection): as specified in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition.
 - C. Coarse Aggregate (inlet protection): AASHTO #57 or equivalent.
 - D. Sediment Filter Bag: as specified in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August

2005 or latest edition.

- E. Hay or Straw Mulch

PART 3 - EXECUTION

3.1 General Requirements:

- A. All temporary erosion and sediment control measures indicated on the drawings and specified herein shall be in place before the beginning of any earthwork or site work phase. Refer to general plan notes and details for additional information.
- B. Erosion and sediment control measures shall be inspected weekly and after every precipitation event.
- C. Install erosion and sediment control products according to manufacturer's directions.
- D. Inspect silt barrier fence after every precipitation event.
- E. Remove sediment when it has reached ½ of the above ground height of the silt barrier fence.
- F. All graded or cleared areas shall receive temporary seeding and mulch if subject to erosion for a period of 72 hours or more.
- G. Provide adequate maintenance of erosion and sediment control measures conforming to requirements in the New York State Department of Environmental Conservation, Standards and Specifications for Erosion and Sediment Control, August 2005 or latest edition, and as indicated on the drawings.
- H. Remove sediment from inlet protections and asphalt roadways after each major storm event.

END OF SECTION

SECTION 02410 – AIR SPADING EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work includes hand and/or pneumatic excavation (air spading) in accordance with the plans, specifications, and directions of the Engineer. Air spading areas are defined on the plans, and include areas where trenching or other excavation is required within the drip line of existing trees.

- B. The purpose of air spading is to preserve the primary root structure of the trees, which is defined as preserving roots of 1-inch diameter and larger that do not conflict with proposed utilities or structures. Backfill of soil, granular materials, etc., around roots of 1-inch diameter and larger exposed by air spading may be required. Refer to Part 3 – Execution, below.

1.2 SUBMITTALS

- A. The Contractor shall submit in advance the proposed method of excavation for air spading areas. If a device other than the Air-Spade® is proposed, all product literature and/or description of excavation means and methods shall be submitted for review and approval by the Engineer.

1.3 QUALITY ASSURANCE

- A. Contractor shall notify the Engineer/Owner's Representative prior to air spading excavation and once air spading excavation is complete. Removal of tree roots 1-inch diameter and larger within air spading zones that do not conflict with directly location of stormwater utilities shall be approved by the Engineer/Owner's Representative.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION

3.1 METHODS

- A. Prior to beginning work, the area to be trenched/excavated shall be thoroughly wetted, 24 hours in advance, to minimize dust to the greatest extent possible.

- B. Trenching/Excavation shall be accomplished either by hand or with a pneumatic device. All hand excavation shall be completed carefully so as to not damage roots of 1-inch diameter and greater. Acceptable pneumatic equipment includes:
1. Air-Spade® CGP System – Manufacturer: Concept Engineering Group, Inc. Verona, PA,
 2. Or Approved Equal.
- C. The Contractor shall provide a compressor unit for operating the pneumatic excavator rated at one hundred fifty standard cubic feet per minute (150 scfm) at ninety pounds per square foot gauge (90 psfg). All pneumatic excavation shall be as minimal as possible in width and depth, thereby minimizing the impact on tree roots and other areas as noted on the plans. Different nozzles may be used on the air spade to expedite the work or minimize the amount of airborne material.
- D. Depth shall be as indicated on Contract Drawings or as directed by the Engineer. Depths greater than 18” shall require removal of soil by hand shovel, or other appropriate means. Where a pneumatic device is used, care shall be taken to avoid rocks being scattered and inadvertently damaging private or public property. In addition, operators must be equipped with adequate protective clothing and gear, in accordance with manufacturer’s recommendations.
- E. All tree roots exposed by the pneumatic or hand excavation operation must be kept constantly moist with burlap covered with white plastic and checked a minimum of two (2) times a day, once in the morning and once in the afternoon, for a maximum of forty-eight (48) hours, until backfill is complete as directed by the Engineer/Owner’s Representative. If directed, soaker hoses shall be installed to facilitate properly moist conditions.
- F. Necessary inspections of utilities, structures, and backfill shall be scheduled in advance to minimize the amount of time that roots and air spading areas are exposed.
- G. In cases where roots must be cut, the Contractor must receive written approval from the Engineer/Owner’s Representative prior to cutting any roots larger than one inch (1”) in diameter. Roots must be cut cleanly with pruning shears, loppers, or pruning saws. All root cuts must be approved by the Engineer prior to backfilling.

END OF SECTION

SECTION 02515 - STRAIGHT GRANITE CURB (5" x 12")

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under this item the Contractor shall furnish and install granite curbing where shown on the plans or as directed by the Engineer. This item is intended for use at driveway and handicapped access ramp locations.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Curbing shall be from eleven (11") to thirteen (13") inches high, shall have a minimum width on top of five (5") inches and a minimum of four (4") inches at the bottom for not less than two-thirds (2/3) of the length of stone. The minimum length for all straight curb shall be five (5') feet. The use and payment for stone less than five (5') feet in length will be with the approval of the Engineer under this item.
- B. The curbstones shall have a top surface sawed to an approximately true plane. The front and back arris lines shall be pitched straight and true. There shall be no projection on the back surface for three (3") inches down from the top which would exceed a batter of four (4") inches in twelve (12") inches.
- C. The front face shall be at right angles to the plane of the top and shall be smooth quarry split, free from drill holes in the exposed face. There shall be no projections greater than one-half (1/2") inch measured from the vertical plane of the face through the top arris line for a distance of eight (8") inches down from the top. For the remaining distance there shall be no projections or depressions greater than one (1") inch measured in the same manner. The arris lines at the ends shall be pitched with no variation from the plane of the face greater than one-eighth (1/8") of an inch.
- D. The ends of all stones shall be squared with the planes of the top and face, and so finished that when the stones are placed butted end to end as closely as possible no space more than one-half (1/2") of an inch shall show in the joint for the full width of the top or down on the face for eight (8") inches. The remainder of the end may break back not over twelve (12") inches from the plane of the joint.
- E. The curbstones shall be thoroughly cleaned of any iron rust or iron particles.

PART 3 – EXECUTION

3.01 CONSTRUCTION DETAILS

- A. The curb shall be set in a trench, as shown on the plans, and in the following manner: The

trench for the curb shall be dug thirty (30") inches below the adjoining curb grade and eighteen (18) inches wide, with the back of the trench to be eleven (11") inches from the face of the curb. The subgrade shall be graded and tamped smooth prior to placement of the four (4") inch PE pipe drain. A line of four (4") inch perforated polyethylene pipe connected to catch basins so as to drain into the basins, will then be laid at the rear of the bottom of the trench in eight (8") inches of No. 2 stone. A six (6") inch layer of fairly dry concrete, mixed in the proportions of one and one-half (1.5) parts Portland Cement to three (3) parts of Concrete Sand and six (6) parts of coarse aggregates, shall be placed upon the stone foundation as specified above. The coarse aggregate shall be uniformly graded from particles passing a one and one-half (1 1/2) inch screen to those retained on a one-quarter (1/4") inch screen.

- B. In proportioning the materials for the concrete to be used in the curb trench batch boxes or the proper size shall be used. No shoveling of materials directly from stockpiles to the mixer will be allowed. Each mixer used for this type of work shall be fitted with a charging hopper or other approved device. Central plant batching and transit mixing are preferred methods of meeting this requirement.
- C. The curb shall be set carefully to line and grade, with close joints and even and contiguous surfaces, upon the concrete foundation. Wet concrete of the same mix proportions described above is to be placed back of the curb to within six (6") inches of the top of the curb, and in front of the asphalt binder for the pavement, or as ordered by the Engineer.
- D. Where stone curbing is used with any pavement not requiring a concrete foundation, the concrete in which the curb is set shall extend to within three (3") inches of the gutter grade on the front of the curbing.
- E. In cases where it becomes necessary to drain into a catch basin or manhole off the line of the curbing the connection between the curb trench and basin or manhole shall be made with four (4") inch perforated PE pipe, as directed by the Engineer. This four (4") inch perforated PE pipe shall be included in the price bid and shall be surrounded for its entire length, by concrete six (6") inches in thickness, mixed as specified for the curb trench.
- F. At all driveways, Straight Granite Curb (12") as specified in this Section shall be used. The concrete foundation and stone underdrain is to be maintained at the standard thickness described above. On each side of the lowered driveway, the end of the adjoining stones shall be beveled at a slope of one (1) to one (1), from the top of the adjoining curb to the top of the lowered curb. This beveling shall be done by a competent stone cutter. The use of Granite Transition Curb as specified in Section 02517, will eliminate the need for beveling of the curbstone. Curbing at driveway locations shall have reveal of one (1") to one and one-half (1 1/2") inches. Curbing at handicapped access ramps shall have a reveal of one-fourth (1/4") inch.

3.02 RESTORATION OF SURFACES

- A. Unless specified otherwise in the Contract Documents, the Contractor shall provide full restoration of surfaces in front of and behind the curb to their preconstruction conditions.

This work includes furnishing and placement of topsoil, permanent seeding, full restoration of pavements, resetting of sign posts standards, and any other work required to restore these areas to preconstruction conditions, unless specified otherwise in the Contract Documents.

END OF SECTION

SECTION 02516 - STRAIGHT GRANITE CURB (5" x 16")

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under this item the Contractor shall furnish and install granite curbing where shown on the plans or as directed by the Engineer. Use of this item is only with the approval of the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. This curbing shall be from fifteen (15) to seventeen (17) inches high, shall have a uniform width on top of five (5) inches and a minimum of four (4) inches at the bottom for not less than two-thirds (2/3) of the length of stone. The minimum length for all straight curb shall be five (5) feet. The use and payment for stone less than five (5) feet in length will be with the approval of the Engineer under this item.
- B. Except for the above-described dimensions, this curbing shall conform to the materials requirements specified in Section 02515 - Straight Granite Curb (5" x 12").

PART 3 – EXECUTION

3.01 CONSTRUCTION DETAILS

- A. Construction details shall be identical to those specified in Section 02515 - Straight Granite Curb (5" x 12").

3.02 RESTORATION OF SURFACES

- A. Unless specified otherwise in the Contract Documents, the Contractor shall provide full restoration of surfaces in front of and behind the curb to their preconstruction conditions. This work includes furnishing and placement of topsoil, permanent seeding, full restoration of pavements, resetting of sign posts standards, and any other work required to restore these areas to preconstruction conditions, unless specified otherwise in the Contract Documents.

END OF SECTION

SECTION 02520 – PCC SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under these items the Contractor shall construct or replace Portland Cement Concrete sidewalks and/or driveways as shown on the plans or as directed by the Engineer.
- B. The Contractor shall replace the entire PCC panel (concrete and topping courses) for any disturbed PCC area through adjacent panel expansion joint(s). Partial or piecemeal replacement will not be accepted.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. The requirements of the following sections of the current NYSDOT Standard Specifications, Construction and Materials, shall apply unless otherwise indicated in the contract documents:

Portland Cement	701-01
Coarse Aggregates	703-02
Concrete Sand	703-07
Welded Wire Fabric	709-02
Admixtures	711-08
Water	712-01

- B. Concrete for the lower course of two-course sidewalks and driveways shall comply with the requirements for Class A concrete, as defined in the aforementioned NYSDOT Standard Specifications, Table 501-3, "Concrete Mixtures". This concrete shall attain a minimum compressive strength of 3500 psi when tested at twenty-eight (28) days in accordance with ASTM C39-80. The air content of the freshly mixed concrete shall be six (6%), plus or minus one (1%) percent and the slump shall be three and one half (3 -1/2") inches plus or minus one half (1/2) inch.
- C. Non-woven geotextile (drainage filter fabric) shall conform to the following:
 - a. Minimum flow rate of 110 gal/min/ft² ASTM D-4491-99A
 - b. Grab tensile strength min 150 lb ASTM D-4632-91
 - c. Mullen Burst strength min 300 psi ASTM D-3786-87
 - d. Puncture strength min 90 lb ASTM D-4833-00
 - e. Apparent opening size 60-70 US Sieve ASTM D-4751-99A
 - f. Non-woven geotextile shall be Mirafi 160N, or approved equal.

PART 3 – EXECUTION

3.01 CONSTRUCTION DETAILS

A. ADA Compliance

1. Attention of Contractor is called to the following: The work in this contract shall comply with the requirements of the AMERICANS with DISABILITIES ACT of 1990 (ADA). The standard details included comply with the ADA. Sections of the ADA Accessibility Guidelines for Buildings and Facilities: Final Guidelines (ADA-AG), and ADA-AG Appendix should be consulted for further guidance.

B. Excavation

1. Existing deteriorated concrete shall be removed and disposed off the line of work to the satisfaction of the Engineer.

C. Subgrade

1. The subgrade shall be that portion of the ground surface directly beneath the sidewalk slab. Up to 3" of subgrade excavation shall be included in this payment item.
2. The subgrade shall be dressed to a plain surface containing no large stones, roots, sod or rubbish, and shall slope downward toward the roadway one-quarter (1/4") inch per foot laterally, and to such longitudinal grade as may be shown on the plans.
3. After the grading is completed, the surface shall be compacted and, if necessary, all soft or spongy areas shall be removed and replaced with suitable fill material. Fill material shall conform to the requirements of Granular Subbase, as specified in the NYSDOT Standard Specifications, Type 4 subbase or equal approved by the Engineer.

D. Formwork

1. Forms shall be of lumber with nominal thickness of two (2") inches, or of steel of equal rigidity and strength. No forms shall be less than five (5") inches in depth for sidewalks or seven (7") inches for driveways and corners. Flexible strips may be used on curves. The forms shall be staked or otherwise held to the established grade of walk. All forms shall be properly cleaned and wood forms shall be thoroughly wetted, and metal forms oiled, before depositing any material against them.
2. The total thickness of walks shall be five (5") inches and shall consist of a wearing surface course one (1") inch thick placed upon a base course four (4") inches thick. Driveways shall have a total depth of seven (7") inches and shall consist of a wearing course one (1") inch thick placed upon a base course six (6") inches thick.

3. Contraction (tooled) joints shall be placed between expansion joints at equal intervals not exceeding six (6') feet. These joints shall be formed either by the use of division plates (steel), one-eighth (1/8") inch thick, or by approved methods of cutting a groove in the surface of the finished concrete.
4. Where the sidewalk line intersects a building, walk, permanent structure or other location as designated by the Engineer, a one-half (1/2") inch, non-extruding pre-molded expansion joint shall be provided, and placed at intervals not exceeding twenty (20') feet in sidewalks.
5. Expansion joints shall be pre-molded strips of asphaltic felt of the required thickness, as wide as the thickness of the walk, and laid in one piece as long as the full length of the slab.
6. Expansion joints shall extend from the surface to the subgrade, be at right angles to the sidewalk surface and be constructed prior to placing the concrete.
7. Expansion joints shall be filled with a one-part, non-priming, self-leveling polyurethane sealant. Approved products include Sonneborn Sonolastic SL 1 or approved equal.

E. Placing

1. Concrete shall not be placed upon a dry or dusty subgrade. The subgrade shall be sprinkled or lightly wetted before placing the concrete. No concrete shall be placed on a frozen subgrade or when the temperature is or predicted to be within twenty-four (24) hours, less than forty (40°) degrees Fahrenheit, except with written permission of the Engineer.
2. After the concrete course has been brought to the established grade, it shall be struck off and worked with a float in a manner that will thoroughly consolidate it so that the surface has a true contour. The upper edges of the concrete shall be rounded to a radius of one-quarter (1/4") inch.
3. When wet spots occur, finishing operations should be delayed until the water either disappears or is removed with a squeegee. If a squeegee is used, cement should not be removed with the water. Under no conditions shall dry cement or sand be used to absorb this moisture or to hasten the hardening.

F. Curing

1. Concrete shall be allowed to cure for at least three (3) days before forms are removed. Forms shall be carefully removed from the sidewalk so no edge will be broken, and the area adjacent to the sidewalk shall be immediately refilled to the grade of the new sidewalk.
2. All walks shall be protected by suitable coverings and shielded from traffic and the

elements for at least three (3) days and shall not be open to traffic until the Engineer so directs.

3. All concrete walks, curbs, and driveways shall be sprayed with a white pigmented membrane curing compound immediately after finishing. Vapor-proof membranes used for curing will not require wetting. A list of approved membrane curing compounds is included in these contract documents.
4. The Contractor shall provide protection for all concrete placed in cold weather by covering with straw, tarpaulins, insulated blankets, or other approved material, and/or heated by salamanders, if needed to keep concrete temperatures above forty (40°) degrees Fahrenheit to obtain specified concrete strengths.

G. Testing

1. The Owner will employ a qualified third party testing laboratory to perform quality control testing of concrete and mortar used in the construction of sidewalks and driveways.
2. For each concrete placement of fifty (50) cubic yards or less, one series of compressive strength samples shall be fabricated. A series shall consist of three (3) test cylinders of base concrete and two (2) sets of test cubes of mortar topping. (Note that each set contains three (3) cubes.) One (1) concrete cylinder and one (1) set of mortar cubes shall be tested at seven (7) days, and two (2) cylinders and one (1) set of mortar cubes shall be tested at twenty-eight (28) days. Concrete cylinders shall be fabricated in accordance with ASTM C31-69 (1975), and tested in accordance with ASTM C39-80. Mortar cubes shall be fabricated and tested in accordance with ASTM C109-80. Copies of these tests results will be made available to the Engineer and Contractor.
3. Slump tests and air entrainment tests shall be taken on the concrete and mortar as directed by the Engineer in accordance with ACI and ASTM standards.
4. At the discretion of the Engineer, core samples may be taken for testing of thickness and compressive strength. The cost of coring and testing of cores shall be borne by the Owner, and copies of test results shall be made available to the Contractor.
5. If the average thickness of the concrete sidewalk as determined by the measurements of all cores taken on the work is deficient by more than one-quarter (1/4") inch, a deduction will be made from the contract price in the form of a change order. The amount of deduction shall be determined by the Engineer.
6. Any part of the concrete sidewalk or driveway which is deficient in depth by more than one-half (1/2") inch will not be accepted, and at the option of the Owner said sidewalk (or driveway) may be taken up and replaced according to the specification, at the Contractor's expense.

7. Sections of sidewalk for which core or cylinder or cube tests show the strength to be less than ninety (90%) percent of the compressive strength required will not be accepted and shall be replaced at the Contractor's expense.

3.02 NAME PLATE/CONTRACT NUMBER

- A. The Contractor, as required by City Ordinance, shall imprint the concrete work at the beginning, end, corners and every 250 feet, with the Contractor's (and sub-contractor's) name, year of construction, and the contract number under which the work is performed.
- B. The Contractor's imprint numbers shall not be less than two (2) inches nor more than three (3) inches tall. Letters shall be not less than one (1) inch nor more than two (2) inches tall.
- C. The Contractor shall be restricted from imprinting the Contractor's name promiscuously, and shall be guided as to the location of same by the Engineer or the Resident Engineer.

3.03 PROTECTION OF SURVEY MONUMENTS AND UTILITIES

- A. The Contractor shall comply with the requirements of the City's standard SUPPLEMENTAL CLAUSES OF GENERAL APPLICATION to protect City survey monuments and various utilities in or adjacent to the line of work.

3.04 PERIOD OF MAINTENANCE

- A. The Contractor shall remedy, without cost to the Owner, any defects which may occur during a period of two (2) years from the date of completion and acceptance of work performed under this contract, provided such defects are caused by defective or inferior material and/or workmanship.

END OF SECTION

SECTION 02521 - SIDEWALK/DRIVEWAY SEALANT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Under this payment item the Contractor shall install a one-part, non-priming, self-leveling polyurethane sealant to fill expansion joints in sidewalks, driveways or bus pads as directed by the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. A one component, non-priming, urethane, self-leveling, (pour grade) sealant for use in contraction and expansion joints in sidewalks, pavements, decks or other concrete structures shall be used. Approved products include Sonneborn Sonolastic SL 1 or approved equal.
- B. The sealant material shall fully comply with:
1. Federal Specification TT-S-00230C, Type 1 Class A
 2. ASTM C-920, Type S, Grade P, Class 25, Use T, M.
- C. The material used shall meet the following properties:

<u>Property</u>	<u>Test Method</u>	<u>Value (average)</u>
Tensile Strength	ASTM D412	350 Al
Elongation	ASTM D412	800%
Hardness-Shore A	Shore Durometer	43+/-2
Shrinkage		
Weatherability (1000 Hours)	Atlas 6500 Watt Xenon Arc	Excellent
Low Temperature Flexibility	ASTM D746	-40 degrees Fahrenheit
Service Temperature Range		-40 to 180 degrees Fahrenheit

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

- A. Surfaces shall be prepared as directed by the Manufacturer's Instructions.

- B. Joints surfaces shall be structurally sound, clean, dry, and free of all loose aggregate, paint, oil, grease, asphalt, wax, mastic compounds, waterproofing compounds or form release materials prior to the application of the sealant.

3.02 APPLICATION PROCEDURE

- A. The joint sealant should be installed in accordance with Manufacturer's recommendations.
- B. Fresh concrete must be fully cured before installing the sealant material.
- C. Fill joints from the bottom; avoid bridging of the joint which may form air voids. Ideally, the temperature at the time of application should be the median between surface temperature extremes. Thus, the joint width would be at the mid-point of maximum and minimum opening, providing for maximum efficiency of sealant with subsequent joint movement.
- D. Protect joint from dirt and traffic until cured.

3.03 PERIOD OF MAINTENANCE

- A. The Contractor shall remedy, without cost to the Owner, any defects which may occur during a period of two (2) years from the date of completion and acceptance of work performed under this contract, provided such defects are caused by defective or inferior material and/or workmanship.

END OF SECTION

SECTION 02650 - ASPHALT CONCRETE TOP AND BINDER COURSES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This includes all work required to furnish and install Asphalt Concrete, Type 7 Top Course and Type 3 Binder course as per the current NYSDOT Standard Specifications, Section 403, Hot Mix Asphalt Concrete Pavement and Section 407, Tack Coat.
- B. The depth shall be as designated on the Contract Drawings.
- C. This Work also includes:
 - 1. All minor adjustments to City-owned valve boxes, drainage structure frames & grates and manhole rims (less than twelve (12) inches) necessary to finished grade prior to surface application.
 - 2. All necessary maintenance and control of traffic and public notification.
 - 3. The pavement surface area to be treated shall be cleaned by a rotary power broom.
 - 4. The application of tack coat to all structures, vertical edges and the binder course (or other subbase beneath).
 - 5. All incidental work related to this item.

1.2 SUBMITTALS

- A. Informational Submittals: Manufacturer's Certificate of Compliance with Section 400 of the NYSDOT Standard Specifications for the following materials:
 - 1. Aggregate: Gradation, source test results as defined in Section 400 of the NYSDOT Standard Specifications.
 - 2. Asphalt for Binder: Type, grade, and viscosity-temperature curve.
 - 3. Prime Coat: Type and grade of asphalt.
 - 4. Tack Coat: Type and grade of asphalt.
 - 5. Additives.
 - 6. Mix: Conforms to specified NYSDOT Standard Specification formula.

1.3 QUALITY ASSURANCE

- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- C. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction (such as NYSDOT and/or City of Syracuse).
- D. Materials and workmanship shall conform to applicable requirements of NYSDOT Specifications.

1.4 MAINTENANCE AND REPAIR

- A. The two (2) year guarantee for defective or inferior material and/or workmanship shall include the pavement base as well as the wearing surface placed thereon if both were constructed by the Contractors. The guarantee shall include also all structures built and paid for as part of the contract such as manholes, sewers, and basins, as well as Portland Cement concrete sidewalks and driveways, curbs, gutters, and headers.
- B. Where necessary, temporary repairs shall be made during the winter when it is impractical to make permanent repairs. Permanent repairs in such cases shall be made as soon as weather conditions permit.
- C. The guarantee covers all the work over trenches which existed previous to the letting of the contract for the pavement, as well as those which were made by the Contractor in the course of carrying out the provisions of this contract. If the pavement settles over such trenches, the Contractor shall lay and restore the pavement over these in a thorough and workmanlike manner to conform in grade and cross-section with the adjoining pavement.
- D. The right is reserved by the Engineer to allow one or more openings to be made in any portion and the paving done by other persons than this Contractor during the term of this guarantee. In this case, however, the Contractor will not be held responsible for any settlement or other defects in the portion of the pavement re-laid, which in the opinion of the Engineer are due to said opening and repaving. Nothing herein contained shall be construed as affecting the guarantee of the Contractor in any manner upon the remainder of the pavement, and only as aforesaid on the portion re-laid.
- E. Where cracks or subsidence of the wearing surface indicate defects in the pavement foundation, the pavement structure shall be excavated to its full depth and replaced with new material corresponding to the specifications under which the original pavement was laid.
- F. Whenever the repairs necessary to be made at the expiration of the guarantee period in accordance with these specifications shall amount to more than fifty (50) percent of the area of any one block, the entire pavement on the block shall be taken up and re-laid with new pavement, according to the specifications for the original pavement.
- G. At the close of the guarantee period, all defects as above described shall have been corrected, and the pavement left in a good serviceable condition substantially conforming in form to the grade and cross-section originally established.

1.5 REFERENCES

- 1. New York State Department of Transportation Specifications.
- 2. Standards of the American Association of State Highway and Transportation Officials (AASHTO), 19th edition 1998 or latest edition.
- 3. Contract Documents and Specifications for 2010 Annual Street Structures and Rehabilitation at Various Locations within Onondaga County and the City of Syracuse, March 2010.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphalt Concrete, Type 7 Top Course as per the current NYSDOT Standard Specifications, Section 403, Hot Mix Asphalt Concrete Pavement and Section 407, Tack Coat.
- B. Asphalt Concrete, Type 3 Binder Course as per the current NYSDOT Standard Specifications, Section 403, Hot Mix Asphalt Concrete Pavement and Section 407, Tack Coat.

PART 3 - EXECUTION

3.1 GENERAL

- A. Traffic Control:
 - 1. Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.

3.2 LINE AND GRADE

- A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
- B. Shoulders: Construct to line, grade, and cross-section shown.

3.3 APPLICATION EQUIPMENT

- A. In accordance with Section 400 of the NYS DOT Standard Specifications.

3.4 PREPARATION

- A. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.5 PAVEMENT APPLICATION

- A. General: Place asphalt concrete mixture on approved, prepared base in conformance with Section 400 of the NYS DOT Standard Specifications.
- B. Tack Coat:
 - 1. Prepare material, as specified in Section 400 of the Standard Specifications, prior to application.
 - 2. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
 - 3. Do not apply more tack coat than necessary for the day's paving operation.
 - 4. Touch up missed or lightly coated surfaces and remove excess material.
 - 5. Application Rate: Minimum 0.25 liter to maximum 0.70 liter of asphalt (residual if diluted emulsified asphalt) per square meter (0.05 to 0.15 gallon per square yard) of

surface area.

C. Pavement Mix:

1. Prior to Paving:
 - a. Sweep primed surface free of dirt, dust, or other foreign matter.
 - b. Patch holes in primed surface with asphalt concrete pavement mix.
 - c. Blot excess prime material with sand.
2. Place asphalt concrete pavement mix in one single lift.
3. Compacted Lift Thickness:
 - a. Minimum: Twice maximum aggregate size, but in no case less than 25 millimeters (1 inch).
 - b. Maximum: 100 millimeters (4 inches).
4. Total Compacted Thickness: As shown.
5. Apply such that meet lines are straight and edges are vertical.
6. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
7. Joints:
 - a. Offset edge of each layer a minimum of 150 millimeters (6 inches) so joints are not directly over those in underlying layer.
 - b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
 - c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.
8. Succeeding Lifts: Apply tack coat to pavement surface between each lift.

D. Compaction:

1. Uniformly compact each course to target density arrived at in compaction control strip.
2. Joint Compaction:
 - a. Place top or wearing layer as continuously as possible.
 - b. Pass roller over unprotected end of freshly laid mixture only when placing of mix is discontinued long enough to permit mixture to become chilled.
 - c. Cut back previously compacted mixture when Work is resumed to produce slightly beveled edge for full thickness of layer.
 - d. Cut away waste material and lay new mix against fresh cut.

E. Tolerances:

1. General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.
2. Completed Surface or Wearing Layer Smoothness:
 - a. Uniform texture, smooth, and uniform to crown and grade.
 - b. Maximum Deviation: 3 millimeters (1/8 inch) from lower edge of a 3.6-meter (12-foot) straightedge, measured continuously parallel and at right angle to centerline.
 - c. If surface of completed pavement deviates by more than twice specified tolerances, remove and replace wearing surface.
3. Transverse Slope Maximum Deviation: 6 millimeters (1/4 inch) in 3.6 meters (12 feet) from rate of slope shown.

3.6 FIELD QUALITY CONTROL

- A. The Engineer has the right to take core samples and test them as is deemed necessary. Testing costs will be borne by the Owner and results will be made available to the Contractor. Determination of acceptance will be made by the Engineer. Full acceptance will be made if the average density of the cores taken at a location is between 92% and 97% of the mixture's average daily maximum theoretical density. If the average density fails to meet this limit, the quantity placed and the payment according to the Engineer's quantity calculation will be adjusted according to the table below:

Quantity Adjustment Factors:

<u>Average Core Density</u>	<u>Quantity Adjustment Factors</u>
90.0% < Density < 92.0%	90%
88.0% < Density < 90.0%	85%
Density < 88%	Remove/Reinstall Pavement Section

END OF SECTION

SECTION 02720 – DRAINAGE UTILITIES

- A. Skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction (such as NYSDOT and/or City of Syracuse).
- C. Materials and workmanship shall conform to applicable requirements of NYSDOT Specifications.
- D. References
 - 1. Annual Book of ASTM Standards, 2005, or latest edition; American Society for Testing and Materials, Philadelphia PA.
 - 2. New York State Department of Transportation Specifications.
 - 3. Standards of the American Association of State Highway and Transportation Officials (AASHTO), 19th edition 1998 or latest edition.
 - 4. Contract Documents and Specifications for 2010 Annual Street Structures and Rehabilitation at Various Locations within Onondaga County and the City of Syracuse, March 2010.

1.2 PROJECT CONDITIONS

- A. Conform to all conditions and restrictions included in other sections, including erosion and sediment control, protection of vegetation, existing improvements and utilities.
 - 1. All work shall be in accordance with the laws of New York State.
 - 2. The Contractor shall apply and pay for all necessary permits and fees required in the course of his work as required by the governing codes, including NYSDOT.
 - 3. The Contractor shall be responsible for coordinating his work with the work of other trades. Do no work that will damage, displace, or make unnecessarily difficult the installation of the work of other trades.
 - 4. The Contractor shall not cover any work until it has been inspected by the Engineer. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. High Density Polyethylene (HDPE) Pipe and Fittings
 - 1. Solid and Perforated High Density Polyethylene Pipe (HDPE) shall conform to AASHTO M252, ASTM F-405, and ASTM F-667 for materials and fabrication, and shall be smooth lined (dual wall). Solid HDPE pipe joints shall be watertight joints.
 - 2. Continuously Perforated High Density Polyethylene Pipe (HDPE) shall have

Class II perforations per AASHTO M252 (pipe diameters 3 through 10-inches) and AASHTO 294 (pipe diameters 12 inches and greater). Class II perforations shall be located in the outside valleys of the corrugations, be circular and/or slotted, and evenly spaced around the circumference and length of the pipe. The opening area shall be no less than 0.945 square inches per linear foot (pipe diameters 4 through 10-inches), 1.42 square inches per linear foot (pipe diameters 12 through 18-inches), and 1.89 square inches per linear foot (pipe diameters 24-inches and larger).

3. Manufacturers:
 - a. ADS
 - b. Or Approved Equal.

B. Polyvinyl Chloride Pipe (PVC)

1. Shall be SDR 35 PVC in accordance with ASTM D3034.
 - a. Joints: Integral bell and spigot, in accordance with ASTM D3212.
 - b. Minimum SDR: 35.
 - c. Cell Classification: 12454-B or 12454-C, as defined by ASTM D1784.
 - d. Fittings: SDR 35 minimum wall thickness.
 - e. Gaskets: Factory fabricated rubber compression type with solid cross section in accordance with ASTM F477. Lubricant for joining pipe as approved by pipe manufacturer.
2. Color: White or Blue.
3. Labeling: Shall be labeled "STORM" and shall have flow arrows in direction as indicated on the Plans.
4. PVC pipe shall be manufactured with titanium dioxide for ultraviolet protection per ASTM standards.

C. PVC Catch Basins

1. PVC catch basins (risers) with domed ductile iron (DI) grates, heavy duty H-25 covers, or H-10 pedestrian grates as noted on plans.
2. PVC catch basins utilizing heavy duty H-25 covers shall be installed per manufacturer's specifications and backfill requirements.
3. Where applicable, PVC catch basin weirs shall be custom manufactured stainless steel. The weirs shall be fabricated and mounted by the PVC catch basin manufacturer to the catch basin, and anchored on the bottom and sides with stainless steel anchor bolts. All seams with the PVC catch basin shall be water tight.
4. Where applicable, PVC catch basin filter baskets shall be Nyloplast "Catch-It" filter baskets or approved equal.
5. Manufacturers:
 - a. Nyloplast
 - b. Or Approved Equal

D. Precast Concrete Structures, Curb Inlets, and Risers

1. Shall be per NYSDOT Standards and Specifications. Contractor shall submit shop drawings for Engineer's approval.
2. Where used, curb inlet filter inserts shall be Ultra Urban by Abtech Industries, or Approved Equal.

- E. Trench Drain
 - 1. Trench drains shall be pre-engineered polymer concrete with heavy duty, ADA-compliant ductile iron frame and grate.
 - 2. Manufacturer:
 - a. Polydrain by ABT, Inc.
 - b. Or Approved Equal
 - 3. Where used, filter inserts for trench drains shall be Flogard Lopro by Kristar or Approved Equal.

- F. Anti-Seep Collars
 - 1. Anti-seep collars shall be two-piece HDPE collars. Install anti-seep collars on storm pipes approximately one foot from the edge (outside) of the infiltration bed, or as indicated on the plans.
 - 2. Manufacturers:
 - a. Lane Enterprises
 - b. Or Approved Equal

- G. Light Stone Fill (Rip Rap)
 - 1. As specified in the NYSDOT Standard Specifications, Section 620, size and shape designations from Figure 620-1.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which work is to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 EXCAVATION, BACKFILLING, AND COMPACTION – DRAINAGE UTILITIES

- A. Grade trench bottom to a smooth, firm, stable and rock-free foundation. Remove unstable, soft, and unsuitable materials, as determined by the Engineer, and backfill with clean granular material to indicated level, per NYSDOT specifications.
- B. Backfilling includes all refilling of excavations and the tamping and rolling required for satisfactory compaction. Backfilling shall be done as promptly as possible without damage to pipe or structure in place. Backfilling will be done following inspection and approval of the work by the Engineer or Owner's representative, and only with permission of the Engineer or Owner's representative.
- C. No part of a pipe line or other structure that needs to be tested, located, or measured, shall be filled over or around until required tests and measurements have been made or witnessed by the Engineer or Owner's representative, and their permission so given to backfill. Any backfilling without authorization shall be uncovered by the Contractor at his own expense.

- D. All pipes shall be laid on an even and uniform bedding surface. The bedding shall be installed from a depth of six inches (6") below the pipe barrel unless otherwise shown. Bell holes and depressions for joints of the pipes shall be dug after the bedding materials have been properly graded. The pipe shall then be laid to its true grade and alignment. The bedding materials shall then be shovel placed and hand tamped to fill all spaces under and adjacent to the pipe to hold the pipe in its true grade and alignment during the test. The lines, grades, and joints of the pipes will be inspected before any further backfilling above the pipe is commenced. After the inspection is completed, the backfilling shall be continued in layers not exceeding six inches (6") to a height twelve inches (12") above the top of the pipe. The materials shall be placed with hand shovels and shall be solidly rammed down. Stones smaller than one inch (1") shall be used around the pipe. Note: Perforated pipes will be installed directly within the infiltration trench stone as shown; no additional bedding is required.
- E. From twelve inches (12") above the top of the pipe, suitable backfill material, conforming to the requirements of these specifications may be used. The compaction shall be done for the full length of the pipe, and in such a manner as not to disturb or damage the pipe. Hand-operated mechanical tampers may be used for compaction. Such mechanical tampers shall have a rating of at least 300 feet/lb. of energy per blow.
- F. From one foot (1') above the top of the pipe, machine backfilling and compaction may be used. Above this level, except for the last two feet (2'), small stones not larger than six inches (6") in their greatest dimension will be permitted, but this should not be in excess of 15% of the total volume of the backfill materials in the entire depth. Such stones shall be evenly distributed throughout the entire mass.
- G. The excavated material removed from the trenches can be used for backfilling purposes provided it meets the material classifications. In the areas where the conditions require the removal of the excavated materials, all the backfilling shall be done using crushed stone backfill. The backfilling materials should compact readily by the usual methods of tamping and puddling. Unsuitable materials, such as clay that will crumble under light pressure by hand, frozen materials, ashes, cinders, tree stumps and other organic and unsuitable materials shall not be used for backfilling. Organic soil will not be permitted as backfill.
- H. The materials backfilled in trenches shall be deposited in layers not exceeding six inches (6"). All backfill shall be properly moistened or dried to within 2% of the optimum moisture content as determined by ASTM D-1557. Each lift shall be compacted to 95% maximum density. The degree of compaction shall be checked by a state-certified testing agency, and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the Owner's Representative. The fill shall be compacted to elevations and limits indicated on the plans.
- I. The compaction shall be continued to the desired elevations. The trenches shall be molded to a height of one foot (1') after compaction with suitable materials. All the backfilling and compaction shall be continued without interruption to completion. The areas shall be properly cleaned and all the excess material shall be properly disposed of from the work area.

3.3 PIPE LAYING

- A. All pipes shall be unloaded, handled, and stored in conformance with the manufacturer's recommendations.
- B. Bedding and laying of pipe shall be in accordance with the pipe manufacturer's recommendations. Pipe joints shall be made in accordance with joint manufacturer's recommendations.
- C. All pipe shall be laid on a minimum six inch (6") thickness of NYSDOT No. 2 aggregate, unless otherwise noted on the plans or approved by Engineer.
- D. Pipe placement and alignment shall be accomplished only in the presence of the Owner or their authorized representative. Adequate and suitable equipment and appliances for safe and convenient handling and laying of pipes shall be used. The Contractor shall give two (2) days notice of the time scheduled for the pipe laying and inspection.
- E. Prior to being lowered into the trench, each pipe and fitting shall be carefully inspected, and those not meeting specifications or are otherwise defective shall be rejected and removed from the project.
- F. If, in the opinion of the Engineer or Owner's representative, the materials furnished or the methods of installation are not in accordance with the Specifications or generally accepted practices for that type of work, such work may be stopped by the Engineer.
- G. Pipes shall be laid true to the grades shown on the plans. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. Any pipe which has its grade or joints disturbed after laying shall be taken up and relaid. The pipe sections shall be inspected, and the interior and ends of all pipe will be cleaned before lowering into the trench. During construction, the Contractor shall use all precautions to keep the trench clean and clear of deposits and free from injury until finally inspected and accepted.
- H. Pipe shall be laid so that when completed, the interior bore will conform accurately to grades and alignment indicated by the contract documents or directed by the Engineer or Owner's representative.
- I. Before joints are made, each pipe shall be well bedded, and no pipe shall be brought into position until the preceding length has been thoroughly secured in place. Coupling or bell holes shall be dug sufficiently large to insure the making of a proper joint.
- J. The excavation into which the pipe is being laid shall be kept free from water, and no joints shall be made under water. Water shall not be allowed to rise in excavation until joint is complete. Care shall be used to secure water tightness and to prevent damage to joints during backfilling. All pipe joints shall be watertight within allowances established by these Specifications.
- K. No pipe shall be laid upon a foundation into which frost has penetrated, nor anytime when the Engineer or Owner's representative shall deem that there is a danger of formation of ice or penetration of frost at the bottom of excavation. Where the foundation is unstable or consists of rock, a stone or gravel foundation shall be placed

and tamped to form an acceptable bed for the pipe.

3.4 INSTALLATION OF STRUCTURES

- L. The Contractor shall provide an excavation of sufficient size to accommodate the outside dimensions of the structure as shown on the plans. Prior to setting the unit, the Contractor shall prepare a 6-inch minimum leveling course of compacted NYSDOT No. 1A aggregate suitable for receiving the structure. The base material shall be compacted and leveled to the elevations shown on the plans.
- M. The Contractor shall provide sufficient labor and equipment to unload and place the units. Should rental of a crane be required for unloading and setting the unit, it shall be coordinated by the Contractor with the manufacturer's dispatch office in sufficient time to acquire the equipment.
- N. The completed installation shall be neat and watertight.
- O. Install PVC catch basins, Nyloplast or approved equal, as per the manufacturer's specifications.

END OF SECTION

SECTION 02920 - LAWNS AND GRASSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.
2. Sod.
2. Turf renovation.
3. Erosion Control Blanket.

1.2 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: See Planting Soil Specification Section 02941.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
2. Erosion Control Blanket: Include product data and installation instructions, including surface preparation and material lists.

B. Certifications

1. Grass Seed: Certification of seed analysis, germination rate, and inoculation. Include the year of production and date of packaging. Certify that each lot of seed has been tested by a testing laboratory certified in seed testing within 6 months of delivery date. Also include:
 - a. Name and address of laboratory
 - b. Date of Test
 - c. Lot Number for each seed certified
 - d. Test Results: Name, Percentages of purity and of germination, and weed content for each seed mix.
2. Sod: Certification of sod; include source and harvest date of sod, and sod seed mix.
3. Erosion Control Blanket: From manufacturer stating that the product meets or exceeds all product requirements specified in Section 2.5 below.

C. Qualification Data: For qualified landscape Installer.

D. Product Certificates: For soil amendments and fertilizers, from manufacturer.

E. Material Test Reports: For Planting Soil; see Specification Section 02941.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the New York State Nursery Landscape Association or the American Nursery and Landscape Association.
2. Experience: 5 years' experience in turf installation in addition to requirements in Division 1 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Qualification of Foreman or Crew Leader: All work shall be supervised by a foreman or crew leader who is a certified landscape professional.
 - a. Landscape professional shall be a New York State Certified Horticulturist or a Landscape Technician certified by the New York State Nursery Landscape Association.
 - b. Certification shall be current.
5. Maintenance Proximity: Not more than 2 hours' normal travel time from Installer's place of business to Project site.
6. Qualification of Pesticide/Herbicide Applicator: All work of pesticide/herbicide application shall be done by a person licensed by the State of New York to apply pesticides/herbicides as specified in this section.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PRODUCT HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep dry during storage.
- B. Sod: Do not harvest sod if excessively dry or wet to the extent survival may be adversely affected. Roll or stack to prevent yellowing and deliver and lay within 24 hours of harvesting. Keep moist and covered to protect from drying from time of harvesting until laid. Harvest and deliver sod only after laying bed is prepared for sodding.
- C. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.6 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Spring Planting: 15 April - 15 May.
 - 2. Fall Planting: 1 September - 15 November.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.7 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 - 1. 60 days from date of Substantial Completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

- C. Contractor: Perform maintenance operations during maintenance period to include:
1. Watering: Keep surfaces moist.
 2. Washouts: Repair by filling with topsoil, liming, fertilizing, seeding, and mulching.
 3. Mulch: Replace wherever and whenever washed or blown away.
 4. Mowing: Mow to 2 inches after grass height reaches 3 inches and mow to maintain grass height from exceeding 3-1/2 inches.
 5. Protection Fences: Repair and maintain until satisfactory stand of grass is established.
 6. Reseed unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.
 7. Reseed/replant entire area if satisfactory stand does not develop by July 1 of the following year.

PART 2 PRODUCTS

2.1 SEED

- A. Seed: Fresh, clean, dry, new-crop seed complying with Association of Official Seed Analysts (AOSA's) "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed. See drawings for seed mix(es) and application rates.

2.2 SOD

- A. Strongly rooted pads, capable of supporting own weight and retaining size and shape when suspended vertically from a firm grasp on upper 10 percent of pad.
1. Grass Height: 1-1/2 to 2-1/2 inches.
 2. Strip Size: Supplier's standard.
 3. Soil Thickness: Uniform; 1 inch plus or minus 1/4 inch at time of cutting.
 4. Age: Not less than 10 months or more than 30 months
 5. Condition: Healthy, green, moist; free of diseases, nematodes and insects, and of undesirable grassy and broadleaf weeds. Yellow sod, or broken pads, or torn or uneven ends will not be accepted.
 6. Sod Species: See Contract Drawings

2.3 PLANTING SOILS AND AMENDMENTS

- A. Planting Soil: See Planting Soil Specification Section 02941.

2.4 MULCHES

- A. Where required, utilize Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley; free of noxious weeds.

2.5 PESTICIDES/HERBICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the erosion control layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.6 EROSION CONTROL BLANKET

- A. Erosion Control Blanket shall be open, flexible, and dimensionally stable network of fully-biodegradable, bonded, interlocking fibers. The blanket shall have a functional longevity of up to 12 months. Blanket fibers shall be turf green color or natural wood/straw color.
 - 1. Seed Mix areas: Futerra F4 Netless by Profile Products LLC,
 - 2. Or approved equal

2.7 FERTILIZER

- A. Fertilizer shall be commercial, chemical type, uniform in composition, free-flowing, conforming to state and federal laws, and suitable for application with equipment designed for that purpose.
- B. Fertilizer shall have a minimum percentage of plant food by weight for the following: Permanent fertilizer mix shall be 10 percent nitrogen, 10 percent phosphoric acid, and 10 percent potash.
- C. Application rate shall be determined by the soil analysis results.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to depths shown on Contract Drawings. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening. Apply evenly over area in accordance with manufacturer's instructions.
 - 2. Thoroughly blend planting soil and any soil amendments off-site before spreading, apply fertilizer on surface, and thoroughly blend.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 3. Spread planting soil to depths shown on Contract Drawings but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet. Reduce elevation of planting soil to allow for thickness of erosion control blanket.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 8 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - 3. Remove stones larger than 2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain Engineer's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. See Contract Documents for seed application rate.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter soil uniformly to a thickness of 3/16 inch, and roll surface smooth.
- E. Protect seeded areas with erosion control blanket. Install per manufacturers recommendations.
 - 1. Futerra F4 Netless by Profile Products LLC,
 - 2. Or Approved Equal

3.5 SODDING

- A. Do not plant dormant sod, or when ground is frozen
- B. Lay sod to form solid mass with tightly fitted joints; butt ends and sides, do not overlap.
 - 1. Stagger strips to offset joints in adjacent courses.
 - 2. Work from boards to avoid damage to subgrade or sod
 - 3. Tamp or roll lightly to ensure contact with subgrade; work sifted soil into minor cracks between pieces of sod, remove excess to avoid smothering adjacent grass.
 - 4. Complete sod surface true to finished grade, even, and firm.

3.6 TURF RENOVATION

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - 2. Install new planting soil as required.
 - 3. Replace damaged turf areas with the proposed turf species within limits of construction, and renovate/restore existing conditions outside of the limit of construction.

- B. Remove any erosion control matting and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly. Install new planting soil to meet finish grades.
- I. Apply seed and protect with erosion control blanket, straw mulch, planting soil, or otherwise as required for establishing new turf.
- J. Water newly planted areas and keep moist until new turf is established.

3.7 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-soil/re-mat to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where erosion control blanket has been disturbed by wind or maintenance operations, add new erosion control blanket and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Only as necessary to establish turf within Contract period specified.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow sod and seeded areas to 2 inches after grass height reaches 3 inches, and mow to maintain grass height from exceeding 3-1/2 inches. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted.

Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.9 PESTICIDE/HERBICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 02930 – EXTERIOR PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior Plants.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- G. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, ground covers, ornamental grasses, or herbaceous vegetation.
- H. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- I. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- J. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- K. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

- L. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- M. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Plant Photographs: Include color photographs in digital 3- by 5-inch (76- by 127-mm) print format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Samples for Verification: For each of the following:
 - 1. Groundcover: Three samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
 - 2. Organic Mulch: 1-quart (1-liter) volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- D. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified landscape Installer whose work has resulted in successful establishment of plants.
1. **Professional Membership:** Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. **Experience:** Five years' experience in landscape installation.
 3. **Installer's Field Supervision:** Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. **Personnel Certifications:** Installer's field supervisor shall have certification in the following categories from the Professional Landcare Network:
 - a. **Certified Landscape Technician - Exterior,** with installation and maintenance specialty area(s), designated CLT-Exterior.
 5. **Pesticide Applicator:** State licensed, commercial.
- B. **Soil Analysis:** For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
1. The soil-testing laboratory shall oversee soil sampling.
 2. Report suitability of tested soil for plant growth.
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
- C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- D. **Measurements:** Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. **Trees and Shrubs:** Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes
- E. **Preinstallation Conference:** Conduct conference at project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Packaged Materials:** Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk soil amendments with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball.
- E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 - 1. Notify Owner no fewer than three days in advance of proposed interruption of each service or utility.
 - 2. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Spring Planting: April 15 – June 15th.
 - 2. Fall Planting: August 20 – October 15th.
 - a. Tree Fall planting can be extended until November 15th.
- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 2. Warranty Periods from Date of Planting Completion:
 - a. Trees, Shrubs, Perennials, Ornamental Grasses, and Other Plants: 12 months.
 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
1. Maintenance Period for Trees, Shrubs, Ground Covers, and Other Plants: 12 months from date of planting completion
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings

and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

- B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- C. Perennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 PLANTING SOILS AND ORGANIC AMENDMENTS

- A. Refer to Section 02941 Planting Soils

2.3 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
- E. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.4 EROSION CONTROL BLANKET

- A. Erosion Control Blanket shall be open, flexible, and dimensionally stable network of fully-biodegradable, bonded, interlocking fibers. The blanket shall have a functional longevity of up to 12 months. Blanket fibers shall be turf green color or natural wood/straw color.

1. Mesic Plug Mix, Transitional Plug Mix, and Shade Plug Mix areas: ECSC2B - 70% Straw/30% Coconut Blanket with Organic Jute netting and Biodegradable thread
2. Or Approved Equal

2.5 MULCHES

- A. Organic Mulch: Shredded hardwood.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.6 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

- 2.7 Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations per Contract Documents. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply antidesiccant to trees using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING AREA ESTABLISHMENT

- A. See Planting Soils Section 02941.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter.
 - 2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
- B. Subsoil and topsoil removed from excavations may not be used as planting soil.

3.5 TREE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. . If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set stock plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.
 - 1. Use planting soil (See Section 02941) for backfill.
 - 2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Continue backfilling process. Water again after placing and tamping final layer of soil.

3.6 TREE AND SHRUB PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees and shrubs according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.7 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and **as indicated** in even rows with triangular spacing.
- B. Use planting soil See Section 02941 for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.8 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees in Turf Areas: Apply organic mulch throughout plant bed to an average thickness, of 3-inch (75-mm). Do not place mulch within 6 inches (150 mm) of trunks.
 - 2. Organic Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of mulch over whole surface of planting area, and finish level with adjacent finish grades. .

3.9 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.10 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.11 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 02941 - PLANTING SOILS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

1.2 SUMMARY

A. Scope of Work:

The work of this Section consists of all site preparation work and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to the following:

1. Evaluation of rough subgrade water infiltration.
2. Planting soil material acquisition.
3. Testing and analysis for specification conformance.
4. Inspection and testing of subgrade for preparation of subgrade.
5. Preparation of mixes and testing for conformance.
6. Installation and placement of soils.
7. Installation and placement of landscape underdrainage piping
8. Decompaction of soils.
9. Mock-up of planting soil profiles.
10. Final in-place testing of soils.
11. Coordination with other trades.
12. Clean-up.

B. Related Work Under Other Sections:

Carefully examine all of the Contract Documents for the requirements that affect the work of this Section. Other specification Sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 02720 – Drainage Utilities
2. Section 02725 – Subsurface Infiltration Bed
3. Section 02930 – Exterior Plants
4. Section 02920 – Lawns and Grasses

C. Definitions:

1. *Compaction*: Compaction of the soil fabric is any force applied to the soil that reduces porosity and where 90 percent of all compaction can be accomplished with only three applications of force under optimum soil moisture conditions.
2. *Dry Soil*: The condition of the soil at or below the wilting point of plant available water in which the soil is powdery and subject to blowing.
3. *Frozen Soil*: The point at which the soil water has frozen and the soil has become very hard and cloddy. Ice crystals can be seen in the pore spaces of the soil.
4. *Field Capacity*: The percentage of water remaining in a soil two or three days after having been saturated and after free gravimetric drainage has ceased.

5. *Moist Soil*: The condition of the soil in where it can be formed into a ball and maintain its shape. Deformation of the soil is difficult with hand pressure. Free water is not visible and is usually considered the point between the wilting point and field capacity of the soil.
6. *Saturated*: All the pore space within a soil is filled with water and the remaining water is under gravitational forces to drain through the profile.
7. *Scarification*: The loosening of the surface of a soil lift by mechanical or manual means to alleviate compaction of the soil surface. Depth of scarification is dependent on material and extent of compaction. Depths are noted within the specifications.
8. *Subsoil*: The soil horizon directly below topsoil that provides water holding and structural support to plants. Source of the majority of micro-nutrients.
9. *Subgrade*: The in-situ soil material that the planting soil will be installed upon.
10. *Topsoil*: The mineral surface layer of soil that exhibit obliteration of all or much of the original rock structure and must show the following: (1) an accumulation of humified organic matter closely mixed with the mineral fraction and not dominated by properties characteristic of subsurface horizons; (2) has reasonable tilth (biological, chemical and physical properties) to support plant growth; and have two or more of the following:
 - a. a bulk density of less than 1.5g/cc installed
 - b. less than 15 percent by weight coarse fragments greater than 2mm
 - c. identifiable structure between clods called peds, no massive structure
 - d. no contamination (ie. Toxic weeds, chemicals, heavy metals, construction debris)
11. *Wet Soils*: Soils that are considered wet will easily be deformed by hand pressure, maintain their shape, and free water will be visible within the pore spaces. The water content at this soil condition is considered at field capacity or wetter.

D. Qualifications and Quality Assurance:

1. *Analysis and Testing of Materials Qualifications*: For each type of packaged material required for the work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized laboratory made in strict compliance with the standards and procedures of the following:

American Society of Testing Materials (ASTM)
 American Society of Agronomy
 Soil Science Society of America
 Association of Official Agricultural Chemists.
 U.S Composting Council

2. *Quality Assurance Qualifications*: Work and materials shall meet the standards of the following references:

International Society of Arboriculture (ISA)
 American Society for Testing Materials (ASTM)
 Environmental Protection Agency (EPA)
 New York Department of Conservation (NYDEC)

3. *Installer Qualifications*: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
 - a. *Installer's Field Supervision*: Require Installer to maintain an experienced full-time supervisor on Project site who has at least 5 years experience with projects of similar scale and complexity.
 - b. The Landscape Contractor shall have experience in the proper and safe transportation and installation of soil material.

- c. The Landscape Contractor shall have adequate supervision, staff, equipment and experience needed to complete a project of this magnitude..
- d. The Landscape Contractor shall prepare and present to the Engineer required soil submittals, and their associated specified test results at a absolute minimum of four weeks prior to the scheduled soil and plant installation.
- e. The Landscape Contractor shall have at between 3 to 5 years experience in installing designed soil mixes.

4. *Soil Mixing Contractor Qualifications:*

- a. Shall be able to provide soil mixes that meet the specifications within tolerances assigned.
- b. Shall be able to produce enough consistently uniform soil material for the project to meet the scheduled demands.
- c. The soil mixing contractor shall be engaged at least six weeks prior to scheduled soil installation to allow for sufficient time for material searches and initial planting mix approval.

5. *Testing Laboratory Qualifications:* An independent laboratory, recognized as an agricultural based testing agency, with experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

- a. Employ a qualified independent testing and inspection laboratory acceptable to the Engineer and Owner to perform tests and certifications indicated.
- b. It is the responsibility of Landscape Contractor in conjunction with the Soil Supplier to submit material for the soil and compost tests.
- c. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and follow standards from ASTM, EPA, and/or Methods of Soil Analysis, Soil Science Society of America.
- d. Approved Laboratories, other equivalent laboratories can be substituted, but require approval by the Soil Scientist:
- e. *Testing Laboratories:* These are some examples of testing facilities that can accomplish part of or complete testing of all soil mixes:

Atlantic Testing Laboratories	6085 Court St., Syracuse, NY	315-699-5281
Norm Hummel (Hummel & Co.)	35 King Street, PO Box 606 Trumansburg, NY	607-387-5694
CME Associates, Inc.	PO Box 1824, 8560 Brewerton Rd., Cicero, NY	315-698-9315
PW Laboratories, Inc.	6544 Fremont Road, East Syracuse, NY	315-437-1420

1.3 SUBMITTALS AND TESTING

- A. *Certificates:* Provide certificates required by authorities having jurisdiction, including any composted materials containing sewage sludge and material sources as defined by the Sites documentation. Approval as EPA Type 1 “exceptional quality” is required as well standards for application of composted organic material by state or local regulations.

- B. *Testing Intervals for Organic Amendments, Planting Soil Mixes:* Testing is required at the following intervals:
1. Testing of the organic compost material: Test certificates required for producers of municipal yard waste composts or composted biosolids are described within this Section 02941 Part 1 and shall follow criteria listed within Part 2 of this section.
 2. Submit complete test results and samples of the S3, S2, S1, and organic soil amendment materials for approval as described within Part 1 following criteria of Part 2 of this section.
 3. After test results for the composted organic material have been accepted the Contractor shall create sample soil mixes for the S1 layer for the planting soil mix and perform the complete tests described in Section 02941, Part 1.
 4. In-place planting soil testing shall follow methods specified in Part 1 of this section for the layers and intervals noted following the specific ranges and limits noted within Part 2 of this section. Incomplete test results shall not be reviewed delaying the approval process.
- C. *Test Procedures and Reporting:* Submit certified report for each test required. Each test report shall have its associated soil layer clearly marked along with the name of the soil supplier and soil material product name or designation. Only complete submittals with all corresponding test results and samples as list within Part 1 will be reviewed. Submit test results for compost and S3, then after approval, mix and submit the S1 layer.
1. *Compost:* Analyses of composted organic materials, including composted biosolids, are required prior to initial soil mix acceptance. Analyses shall include all tests specified below and meet the criteria listed in Part 2 of this section. Incomplete test results will not be reviewed, delaying submittal approval.
 - a. Maturity index either by Solvita, Dewar Self Heating or CO₂ evolution sometimes called respirometry.
 - b. Reaction in 1:1 water
 - c. Carbon/Nitrogen ratio
 - d. Foreign Material on a dry weight basis
 - e. Organic Mater percent on a dry weight basis
 - f. Ammonium-N using an extract method
 - g. Salinity using a 1:1 water paste method
 - h. Basic Nutrient content of macro nutrients (P, K, Ca, Mg)
 - i. If the compost material contains any biosolids, heavy metals must be tested to meet EPA Chapter 503 and/or the New York State levels for human use.
 2. *Soil Mixes and Topsoil:* Testing shall be performed and reported for particle size requiring percent of gravel (>2.0 mm), very coarse sand (2.0 – 1.0 mm), coarse sand (1.0 – 0.5 mm), medium sand (0.5 – 0.25 mm), fine sand (0.25 – 0.10 mm), very fine sand (0.10 – 0.05 mm), silt (0.05 – 0.002 mm) and clay (< 0.002 mm). Ammonium-N content, conductivity, soil reaction (pH), basic macro nutrients, CEC and organic matter percentage on a dry weight basis shall also be tested as specifically noted below.
 - a. Particle size distribution by ASTM F1632-03 for all soil layers and topsoil. Fines passing the #270 sieve are to be measured using the hydrometer method as outlined in ASTM F1632. If any alternate method is used, the results still must be reported at the specified particle size breaks listed above or by plotting as a particle size distribution curve on a five cycle semi-log graph.
 - b. Organic matter content by ASTM F 1647, commonly known as loss on ignition.
 - c. Salts and Ammonium test using Woods End Research Laboratory # 104 Soluble Ion Test or 1:2 soil/water extract test as specified in *Methods of Soil Analysis, Part 3* and must be

tested and made available to the Engineer or Soil Scientist within two weeks of planned soil installation.

- d. Plant available Phosphorous, Potassium, Magnesium, Calcium and Cation Exchange Capacity tested for the S1 Planting Soil Mix. Quality Assurance samples shall complete only particle size distribution, conductivity (EC), organic matter content, pH, ammonium-N for the S1 material.
 - e. Quality Assurance testing for S3 shall consist of particle size distribution by ASTM F1632, organic matter content, pH and conductivity (EC).
- D. *Sources for Soil Components and Planting Soil Mixes:* Submit information identifying sources for all soil components and the contractor responsible for mixing of planting soil mixes.
1. Owner or Engineer shall have the right to reject any soil supplier that cannot meet the testing requirements in a timely fashion, cannot provide timely deliveries, or cannot provide required quantities and/or uniform material.
 2. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
 3. Submit supplier name, address, telephone and fax numbers and contact name.
 4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project. Indicate quantity and type of material from each supplier.

1.4 QUALITY ASSURANCE / ACCEPTANCE

- A. *Planting Soil QA:* During the placement of planting soils, test every 200 cubic yards (or one test for every planting area) of planting soil mix delivered to the job site. Tests shall be for soil mix quality assurance. Required tests for all layers include particle size distribution, pH, and organic matter. Report organic matter content on a percent by weight basis. Additional tests for salts (EC) and Ammonium-N shall be completed for S1 soil layer only. Testing procedures are described in Part 1 of this section.
- B. *Samples:* Planting soils requires a long lead time. Prior to ordering the listed materials, submit representative samples of the same organic batches and soil mixes that will be used to the Soil Scientist for selection and approval. Do not order materials until the Owner's approval has been obtained. Schedule at least 4 months for soil ingredient search and initial submittal approval. Delivered materials shall closely match the approved samples.
1. *Organic amendment:* duplicate samples of 1 quart.
 2. *Planting Soils:* duplicate samples of 1 quart for each soil layer after mixing organic material and soil. The Soil Mix shall match the material being placed as closely as possible.
 3. A duplicate 1 quart sample of the soil layers and compost shall be sent to the soil consultant for review.
- C. *In-place Designed Soil Testing:*
1. General planting soil installation for planting beds and bio-retention areas shall be tested using a cone penetrometer or equivalent for approximately one point every 100 ft² at an interval after S3 layer installation and again after complete soil profile installation. The planting soil penetration resistance shall be uniformly increasing in density with depth, not exceeding 275 lbs/in². There shall not be any compacted dense layers within the soil profile greater than 50 lbs/in² than the background resistance. Specific penetration resistance rates are given in Part 2 of this section for each soil layer. Infiltration rates of the soil surface (not in mulch) of the Bio-retention areas shall be tested at one test per basin at the lowest point

- using ASTM 3385 to determine saturated hydraulic conductivity at installation. Records of initial testing will be used to monitor long term performance of the basins with other conductivity testing over time. The soil scientist will also conduct additional investigations on compaction and conductivity based on observed installed soil geomorphological parameters for all Bioretention Basins.
2. In-place Density Tests for any designed soils prescribed under sidewalks and pervious paving surfaces shall be conducted for at least three tests of surface soil density per segment as noted on the drawings. The surface that is to support pavement construction is to be tested. Density testing shall conform to ASTM standards using either ASTM D1556-07 or ASTM D6938-10 and shall be between 88 to 92% of Standard Proctor measured at below optimum moisture content (do not compact planting soils at moisture contents above the "Optimum" line)
- D. *Planting Soil and Compost Submittal Acceptance:* Submittals for planting soil approval must have complete test results attached as specified for each soil, results shall be clearly marked for their corresponding soil layer, clearly labeled with the soil supplier's name, and receipt of soil samples by the Soil Scientist before review of the submittal can take place. Incomplete test results will not be reviewed delaying the approval process.
- E. *Soil Installation Acceptance:* Notify the soil scientist at least 10 days in advance of date of soil placement. Inspection of the soil installation shall take place during placement of the S3 layer while some of the subgrade is visible and another inspection during the placement of the S3 layer before placement of the S1 layer. Final inspection shall take place during S1 installation.
- F. *Partial Acceptance:* Acceptance of partial areas or portions of the total work may be granted at the option of the Engineer or Landscape Architect only if the area to be inspected for acceptance is large, well defined and easily described. The Engineer or Landscape Architect is not obligated to provide partial acceptance of the work.
- G. *Final Acceptance:* Final acceptance shall be defined as the date after which the Engineer and Soil Scientist determine that all work, including Punch List items has been satisfactorily completed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- B. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Owner. Deliver soil materials only after preparations for placement of planting soil have been completed.
- C. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- D. Install planting soil layers directly before planting is to commence. Do not install planting soils so that they over-winter without vegetation. Failure to vegetate the planting soil or allowing partial planting soil installation allows for extensive erosion, compaction, and overall degradation of the planting soil system requiring extensive refurbishment before spring planting.
- E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high. If soil stockpiles greater than six feet high are to be stored for more than two weeks, the contractor shall break down and disperse soil so that mounds do not exceed the six-foot height restriction or thoroughly mix the stockpile once a month.

- F. Vehicular access to the site is restricted. Prior to construction the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access which shall include, but not limited to equipment movements and staging locations
- G. Soil materials shall be covered at least two weeks prior to installation to prevent excess moisture from saturating the soil stockpile. Test for the moisture content of the soil mix using the gravimetric oven dry method as described in Soil Science Society of America, *Methods of Soil Analysis*, Part 1, 1986 at least two days prior to soil installation if planting soil moisture content is questionable or at the request of the civil engineer or soil scientist.
- H. Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after precipitation, nor when frozen. Soil shall be handled only when the moisture content is less than 8 percent by volume.
- I. The planting soil shall be mixed in a ball mill or tub mill fitted with proper screening and paddles. Windrowing the materials is not acceptable, as it does not produce uniform mixing of the components.

PART 2 – PRODUCTS

2.1 SOIL LAYERS (HORIZONS):

A. General

1. All plant mix material shall fulfill the requirements as specified and be tested to confirm the specified characteristics.
2. Samples of individual components of plant mixes in addition to blended plant mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Include verification testing of on-site sub soils through the QA testing. Comply with specific materials requirements specified.
 - a. No base component material or soil components for plant soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Engineer and Soil Scientist.
 - b. If necessary, testing of the soil material components may be requested by the Soil Scientist to facilitate approval of the plant soil mix.
 - c. As necessary, make any and all plant soil mix amendments and resubmit test reports indicating amendments until approved.
3. The Engineer and Soil Scientist may request additional testing by the Contractor for confirmation of mix quality and/or plant soil mix amendments at any time until completion if quality control samples deviate from the specifications and initially approved submittals.

B. *Planting Soil Supply:*

1. In the event that any of the soil materials are not available from the supplier or are not in compliance with specifications herein, the Contractor shall obtain material from other suppliers and conduct tests specified herein to provide materials in compliance with these specifications.
2. The Engineer and Soil Scientist shall be notified of all soil mix substitutions or problems with the planting soil supply in order to assist with a smooth delivery and installation.

C. *Planting Soils:*

1. *Soil layer (S3):* Planting Soil Drainage Layer consisting of a layer of material with a USDA Texture of coarse sand.
 - a. Soil reaction with a pH between 4.5 – 7.0.
 - b. An estimated saturated conductivity of 10 - 25 cm/hour.
 - c. The S3 layer within the bio-retention swale shall have a, uniformly increasing with depth, penetration resistance of < 250 lbs/in² after installation. No dense layers (+ 50 lbs/in² from background rate) are allowed.
 - d. There shall be no visible organic material present in this layer.
 - e. Material can be a natural sand or finely ground recycled glass meeting the following particle size distribution

S3 Soil Layer Particle Size Distribution

Particle Size Class	Passing Sieve No	Range in Percent Passing ASTM F 1632-03
fine gravel	10	95 – 100
very coarse sand	18	80 – 95
coarse sand	35	60 - 80
medium sand	60	10 – 40
fine sand	140	8 – 15
very fine sand	270	1 – 10
silt*		1 – 6
clay*		0 – 4
Chemical		
Organic Matter %	ASTM F 1647-02a	<0.25
pH	1:1 Water	4.5 – 7.0

*determined by hydrometer method in ASTM F1632-03.

2. *Soil layer (S1):* Planting Soil Surface layer. A layer consisting of material with a USDA Texture of sand to loamy sand amended with organic matter (must be tested to meet specs after compost is approved and added).
 - a. The soil specifications shall be that the minimum infiltration rate for planting soil areas stays above 5 cm/hour (2 in/hr) after installation.
 - b. The soil shall have soil moisture content less than 8% by weight for installation.
 - c. The S1 layer shall have a uniformly increasing with depth, penetration resistance of < 120 lbs/in² after installation. No dense layers (+ 25 lbs/in² from background rate) are allowed.
 - d. The particle size distribution shall be:

S1 Soil Layer Particle Size Distribution

Particle Size Class	Passing Sieve No	Range in Percent Passing ASTM F 1632-03
fine gravel	10	95 – 100

very coarse sand	18	90 – 100
coarse sand	35	65 – 85
medium sand	60	30 – 40
fine sand	140	15 – 25
very fine sand	270	9 – 18
silt*		6 – 12
clay*		3 – 6
Chemical		
Organic Matter %	ASTM F 1647-02a	2 – 4%
pH	1:1 water	5.5 – 6.5
EC	1:1 paste	1.5 dS/m
Phosphorous (P)	extract	20 – 100 ppm
Potassium (K)	extract	200 – 600 ppm
Cation Exchange (CEC)	Extract	>8 Meq/100g

*determined by hydrometer method in ASTM F1632-03

D. *Organic Amendment:*

1. Composted Biosolid and municipal yard waste compost producers shall provide the heavy metal certificate of the material delivered as per EPA and state or local standards. Composted organic matter shall have the following criteria:

Criteria	Test Method	Acceptable Range
Type		brewer's waste, or leaf mulches are also acceptable. Composted municipal waste (chipped, shredded and screened wood, leaves, bark, etc.) alone is not acceptable unless it meets all of the criteria noted
Carbon/Nitrogen Ratio		11:1 – 22:1
Degree of Maturity	Dewer Self Heating <u>or</u>	VI – V
	Solvita Maturity Index <u>or</u>	6 – 8
	CO ₂ Evolution	1.2 % C/day
Foreign Material	Dry wt.	< 1" dia. And < 2% (of total)
Organic Matter %	Dry wt.	25 – 75%
Reaction	1:1 water	5.5 – 8.0
Ammonium	extract	< 200 ppm
Nutrient Content	extract	Contains some nitrogen, phosphorus, potassium, calcium, magnesium, sodium and micronutrients including iron, copper, boron, and manganese. Nutrients shall be present in appropriate agricultural and horticultural proportions to prevent ion antagonism.
Heavy Metals	extract	Concentrations of zinc, mercury, cadmium, lead, nickel, chromium, and copper must be below EPA and the state standards for biosolid applications to soils with human activity.

E. *Planting Soil Mix Equivalency Table:*

The mix ratios are rough estimates based on usual components found in the area and their physical properties. Slight adjustments to the mix may be needed to achieve the required planting soil properties.

Layer Designation	Base Material or Equivalent	Second Soil Mix Component	Third Soil Mix Component	Mix Ratio (Volume)
S3 Layer	ASTM C33 Fine Aggregate, non-calcareous Masonry Sand, or fine ground recycled glass	None	None	None
S1 Layer	Approved S3 material	sandy loam*	Approved Compost	3:1:1
		sandy clay loam*	Approved Compost	5:1:1
		loam*	Approved Compost	4:1:1

*USDA soil textures

2.2 SOIL PROFILES

- A. *PROFILE SP-1 – Structural Planting Soil Profile:* This planting soil profile consists of one soil horizon. This soil profile shall be areas noted on the drawings that shall receive tree and/or shrub plantings where tree and/or shrub roots are encouraged to grow under pavement. The pavement layers are separated by geotextile above a compacted S3 layer with a maximum of 30 inches over a scarified and correctly pitched subgrade or underdrainage gravel where noted on the drawings. The S3 layer is variable and shall be thinned based on underground utilities or obstructions to achieve final grade. The basis for the S3 layer is the sand specified in Part 2.
- B. *PROFILE SP-3 – Bio-Retention Basins:* This planting soil profile consists of two soil horizons and a landscape underdrainage filtration gravel bed. This soil profile shall be for areas noted on the drawings that are designated as Bio-retention Basins or open shrub pits. The A horizon (S1 layer) of 6 - 8 inches covered with 2-3 inches of specified approved mulch over a 24 inch layer of S3 material placed on landscape filtration gravel within a excavation correctly pitched to the underdrainage piping. The basis for the S1 is the soil mix specified in Part 2. The S3 layer is coarse sand specified in Part 2 of this section.

PART 3 – EXECUTION

3.1 COORDINATION

- A. *Pre-Installation Examination Required:* The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify the Owner in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means the Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Owner.
- B. *Planting Soil Preparation:* Examine soil and remove foreign materials, stones over 1”, and organic debris over 2” in length. Mix-in amendments as required by tests and as approved by the

Owner. All preparation and mixing shall be accomplished when the soil moisture content is less than 8 percent by volume.

- C. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

3.2 EXCAVATION AND SCARIFICATION

- A. Excavation of the soils shall be accomplished to a depths noted for each soil profile area. All construction debris shall be removed from the planting areas prior to placement of the soil layers. Care shall be taken to avoid working the soil when it has 8 percent moisture content or above.

- 1. *Excavation Depths:* (of the subgrade below final grade where applicable)

- a. All Areas shall be excavated a minimum of 36 inches below final grade or as noted on the drawings for specific locations.

- 2. *Subgrade pitch:* The subgrade shall be pitched toward the underdrainage with an average around 1 percent or about 1.25 inches fall per 10 feet or as noted on the drawings.

- A. Scarification of the Subgrade: Scarification must loosen the compacted surface of the subgrade following final rough grade to a depth of 4 to 6 inches prior to the designed soil placement. Scarify the surface of any compacted soil. If the surface is smooth, smeared, or exhibits a shiny appearance it has been compacted and the surface must be loosened.

- 1. Bare soil areas close to the construction site and areas where traffic was most intense will require deep ripping to a depth of 8 inches with a dozer mounted ripper or other equipment before placing any soil material over them (see location drawings). This will reduce effects of perched water within rooting zones, and decrease the likelihood of down slope seeps.

- a. Lawn areas outside of main construction traffic patterns will only require loosening to a depth of around 5 inches using agricultural or other mechanical equipment.
- b. Areas of compaction containing existing trees will require careful scarification using air spading to a depth of 5-6 inches.
- c. Locations where topsoil was stockpiled or construction material was stored with minor soil compaction should be also loosened using mechanical equipment when areas are cleaned up and renovated.

- 2. Scarify the subgrade after engineered compaction to a depth of 3 to 4 inches. Scarify parallel to the contour of the slope when possible, especially on slopes greater than 4:1. This is to provide teeth to stabilize the sandier soil above.

- 3. The subgrade should be graded so that water will flow away from foundations, have no depressions, or areas where water can collect within the subsoil to cause internal soil drainage issues for plant roots.

- 4. Any gravel, shale, asphalt, concrete, or stone should be removed from the subgrade areas if it will fall within 12 inches of the final grade.

- B. Soil Removal and Stockpiling:

1. Make sure the contractor separates the surface topsoil from the subsoil during excavation. The topsoil should be stockpiled separately from the subsoil. This is to insure that the correct soil layers are placed back in the excavation in the proper order.
 2. Keep the topsoil covered if the construction is taking place during precipitation events to keep the stockpiled soil at moisture contents below optimum compactive moisture. This is usually below 10 percent on a weight basis for natural soils.
 3. Keep planting soil stockpiles less than 6 feet in height to allow for adequate aeration during the storage period.
- C. Remove all organic and coarse (rocks) fragments over 2 inches in diameter in the topsoil.
- D. Replacing the topsoil. Do not spread the topsoil by excessive driving over it or back grading with a bucket. Use tracked equipment to limit the amount of compactive force applied on the soil. Build up the level of the soil so as to allow natural settling of the surface.
1. Current topsoil may not be sufficient to cover the site at the minimum 6 inches needed for plant growth. Use approved imported additional planting soil (S1) for these areas.
 2. Using a natural soil requires that additional care be used when placing the planting soil. The workable moisture content of the soil must be strictly adhered to (between 5 and 10% by weight), and soil must not be moved, worked, or placed when wet, during precipitation events, frozen, or mixed with snow.
- E. If soil is to be placed or renovated, it must be worked at moisture content below field capacity or between 5 and 10 percent moisture content by weight. The soil is too wet if it has clumps or has surfaces with a polished appearance when tillage equipment is used.
1. If planting soil has been kept dry (undercover) and the subgrade is not saturated and the weather has been sunny, installation of the planting soil shall continue not less than 36 hours after a rain event. If the subgrade is considerably saturated (muddy) or has standing water, planting soils shall not be worked until the soil meets moisture standards/dried out.
 2. Never work planting soils when frozen.
- F. Prevention of compacted soils can be accomplished by beginning the work in corners, against walls, or at the center of isolated beds, and progressing outwards towards the borders.

Once planting soils are completely placed, all traffic is prohibited until establishment of the plants and turf. Until complete landscape establishment, traffic should be restricted only to landscape maintenance personnel. Traffic restrictions are typically one growing season to entire landscape establishment and equilibrium.

3.3 MIXING OF PLANTING SOIL

- A. The planting soil shall be mixed in a ball mill or tub mill fitted with proper screening and paddles. Windrowing the materials is not acceptable, as it does not produce uniform mixing of the components.

- B. Mixing of the compost for the S1 layer (topsoil) shall be accomplished in the same manner as the other mixing procedures. The compost shall be moist, but not overly wet. Compost shall not be so wet as to have water squeezed out by hand or so dry as to be easily blown by wind.

3.4 PLACEMENT OF SOIL LAYERS (HORIZONS)

- A. *Examination of Subgrade:* The subgrade shall be examined by the Contractor prior to the start of soil placement and planting. Any issue shall be noted and related to the Owner in writing prior to acceptance of the subgrade by the Landscape Contractor:

- B. Planting Soil Placement:

- 1. *General Soil Placement Procedures:*

- a. Scarify the subgrade to a depth of 4 to 6 inches.
 - b. Installation of planting soils shall be accomplished with small tracked equipment. Back-blading is strictly forbidden as it will overly compact the delicate planting soil. If planting soil has been kept dry and the subgrade is not saturated, installation of the designed planting soil can continue the day after a rain event, unless the subgrade is considerably saturated or has standing water.
 - c. Where applicable, place the first layer of S3 in one 6 inch lift. Compaction of this lift shall consist of light tamping by the installers foot traffic. No mechanical compaction shall be allowed except where otherwise noted.
 - d. Trees to be planted within existing soils must have a tree pit excavated using the following criteria:
 - i. Tree pits will be excavated three times the width of the rootball with a slight pedestal in the center of the pit to support the rootball.
 - ii. The sides and bottom of the tree pit shall be scarified 2-3 inches prior to planting and backfilling.
 - iii. The lower subsoil backfill shall be the excavated material lightly tamped by foot in and around the rootball. Additional compaction is forbidden.
 - iv. The surface topsoil shall be amended with approved compost at the rate of 1 part compost to 3 parts topsoil then placed and not compacted.
 - v. Settlement after construction shall be corrected during the warranty period following these specifications.
 - e. For large trees within the designed soil profile. Large tree (rootballs around 36 inches tall that would sit on about 4 inches of compacted S3) (for smaller trees see 'e' below) planting shall follow these procedures for handling the planting soils in and around the rootballs.
 - i. Adjust the subgrade overall depth to allow 4 inches of S3 material and so that the root flair of the tree will be 1 to 2 inches above final grade
 - ii. There shall be a pedestal of compacted subgrade under each of the tree planting areas. Compact this area to 95 percent of standard Proctor at below optimum moisture content then lightly scarify the pedestal surface. The tree pedestal shall be slightly higher in elevation than the surrounding subgrade to allow drainage away from beneath the rootball.
 - iii. Place at least 4 inches of S3 material on the pedestal area to allow support for the rootball and assist with tree leveling.
 - iv. Install the 6 to 8 inches of the S1 layer after all plantings have been completed.

- f. Trees with rootballs less than 36 inches tall to be planting in the designed sand based soil shall follow these procedures for soil installation and planting. These trees and large shrubs shall be planted after the S3 layer is installed, but prior to the S1 layer installation.
 - i. Compact a pedestal of S3 material to about 90 percent of Standard Proctor at below optimum moisture then lightly scarify the pedestal surface.
 - ii. The soil depth shall be so that the root flair of the tree will be 1 to 2 inches above final grade.
 - iii. Install the 6 to 8 inches of the S1 layer after all plantings have been completed.
 - g. Care shall be taken to maintain the separation between the designed soil layers. Do not mix the S1 or S3 with adjacent layers.
 - h. Reducing the amount of compaction to the soils can be accomplished by beginning the work in corners, against walls, or at the center of isolated beds, and progressing outwards. This limits the amount of traffic needed for installation on the placed soil.
 - i. Planting soils shall never be moved or worked when wet or frozen.
 - j. Penetration resistance shall not exceed 200 lbs/ft² within the S3 and the resistance for the S1 layer shall be less than 120 lbs/ft² except where otherwise noted (under pavement plantings). The planting soil shall be uniformly increasing in density with depth. There shall not be any compacted layers within the soil profile.
 - k. The Contractor shall place barricades as required to prevent any unnecessary compaction of planting soil layers from vehicles, equipment, or pedestrian traffic during construction and vegetation establishment. Any additional compaction of the planting soils must be loosened satisfactorily to meet penetration resistance specifications.
2. *Under Pavement Soil Profile Placement:* For areas designated PROFILE SP-1
- a. Scarify the subgrade to a depth of 4 to 6 inches.
 - b. Place a variable thickness of S3 drainage layer in 6 inch lifts over the scarified subgrade that is correctly pitched to the underdrainage piping. Compaction of this lift shall consist of light tamping by the installers foot traffic. Compact each remaining lift to between 88 to 92 percent of Standard Proctor below optimum moisture. **DO NOT** compact soils above optimum moisture content.
 - c. Scarify each lift surface before applying additional lifts to a depth of 2-3 inches. The final lift below the Geotextile and pavement subbase shall not be scarified.
3. *Bioretention Basin Soil Profile Placement:* For areas designated PROFILE SP-2
- a. The planting soil media shall be mechanically mixed until a homogenous mixture is obtained.
 - b. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations.
 - c. Install approved Bioretention washed crushed stone in the bottom of the retention basins, install perforated piping as per the drawings.
 - d. The planting soil media (S3 layer) shall be placed in lifts of 12 to 18 inches, and spread out by means of an excavator bucket or other means to minimize compaction. Placement of the soil media should only occur when it is at the correct moisture content (not wet or dry), and only when there is no precipitation present.
 - e. The Bio-Retention Basin profile follows the Profile SP-2 thickness unless otherwise noted on the Drawings.
 - f. There shall be no abrupt changes in textural class between layers, as this will inhibit infiltration. **NO soil interlayer filter fabric or compact soil zones.**

- g. The planting soil media should be left to settle for at least one storm event before the final lift so that it can be adjusted in the field to correspond to the plan elevations.
- h. A 3-inch topdressing of approved mulch shall be placed prior to the establishment of vegetation to protect the swale from construction sedimentation. The mulch can be removed after plantings are established.
- i. If blowing of material is a concern, biodegradable netting can be spread over the surface until the facility has gone through several wetting cycles.
- j. The gravel and sand layers shall extend across the entire length and width of the Bioretention Basin as designated on the drawings.

CONSTRUCTION NOTE: For all utility boxes and structures that will be placed completely within the designed soil shall require compacted pedestals to support the structures.

3.5 PROTECTION AND REPAIRS

A. General:

- 1. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials. Landscape contractor shall be the only personnel allowed on areas where planting soil has been installed.
- 2. Within the installation warranty period repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compacted due to subsequent construction operations or weather conditions.
- 3. Scarify or remove and replace material to a depth as directed by the Owner; reshape and re-compact by only hand tamping at the prescribed moisture content.
- 4. Where settling occurs, before pavement installation and final soil installation acceptance, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

B. *Bio-Retention Basin Area Protections:* To ensure proper long-term functionality of the Bio-Retention Basins, several procedures and scheduling will need to be followed while handling planting soil installation around these areas.

- 1. Install protective filter socks and erosion controls after excavation and installation of the underdrainage, gravel, and filter fabric to restrict sedimentation of the Bio-filtration areas.
- 2. Do not install the S3 filter sand prior to planting soil installation. Failure to comply will allow excessive sediment to contaminate the filter sand causing decreased functionality.
- 3. Install the S3 filter sand in conjunction with the application of the S3 layer. Install 3 inches of coarse wood chip mulch to the final surface of the Bio-retention swale to help trap sediment and prevent infiltration of sediment into the filter sand until vegetation establishment. It is highly recommended to install the complete Bio-retention swales in the summer or during several weeks of dry weather to ensure that erosion is kept to minimum.
- 4. Maintain effective erosion and sediment controls throughout the vegetation establishment period.
- 5. Vegetate the surrounding catchment areas as quickly as possible.

3.6 POST INSTALLATION MAINTENANCE

- A. Where settling occurs, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

1. Any post installation changes or amendments to previously approved soils without the Engineer or Soil Scientist's consent are the responsibility of the owner.
- B. Fertilization of planting areas shall be handled after establishment after soil tests have been taken to determine the optimum fertilizer rates.
- C. The following items are the responsibility of the Owner after the guarantee period to ensure the sustainability of the designed soil and plants for the life of site.
1. After one year, collect soil samples in each of the various soil areas and submit them for laboratory testing for fertilizer and liming recommendations.
 2. Each "type" of soil and planting area shall be sampled separately, but similar areas can be grouped. For example, areas of designed soil in turf areas, planting beds (flower and shrub), and turf areas of pre-existing plantings shall to be sampled and tested separately. Fertilization and liming needs to be tailored to each area for maximum effect and to reduce over fertilizing and liming and possible contamination of ground water and runoff.
 3. Repeat soil sampling for these areas every two years after first sampling and fertilize and lime to test recommendations.
 4. Clean and remove sediment build up within all Bio-Filtration Basins on a minimum of a bi-annual basis or less as needed. Removal of sediment on a yearly basis is recommended during the dry summer months so as not to damage/compact the filtration basins.
 5. Inspect and clean out all drainage trenches and subsurface infiltration and underdrainage piping annually.

END OF SECTION