

## SECTION 02216 – MODULAR TREE CELLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Furnishing and installing a modular tree cell system, geotextile, geogrids, sub base material, backfill, drainage system, root barrier, and mulch, and the installation of planting soil.

- B. Related Sections:

- 1. Section 02520 "PCC Sidewalks and Driveways"
  - 2. Section 02630 "Unit Pavers"
  - 3. Section 02720 "Drainage"
  - 4. Section 02725 "Subsurface Infiltration Bed"
  - 5. Section 02911 "Planting Soil for Modular Tree Cells"
  - 6. Section 02930 "Exterior Plants"

#### 1.3 DEFINITIONS

- A. Aggregate Sub Base (below cell frame): Aggregate material between the bottom of the modular tree cell frame and the compacted subgrade below, designed to distribute loads from the frame to the subgrade.
- B. Aggregate Base Course (above cell deck): Aggregate material between the paving and the top of the modular tree cell deck below designed to distribute loads across the top of the deck.
- C. Aggregate Setting Bed – For Pavers (above cell deck): Aggregate material between the aggregate base course and unit surface pavers, designed to act as a setting bed for the pavers.
- D. Backfill: The earth used to replace or the act of replacing earth in an excavation beside the modular tree cell frames to the excavation extents.
- E. Finish Grade: Elevation of finished surface of planting soil or paving.
- F. Geogrid: Net-shaped synthetic polymer-coated fibers that provide a stabilizing force within soil structure as the fill interlocks with the grid.

- G. Geotextile: A geosynthetic fabric, applied to either the soil surface or between materials, providing filtration, separation, or stabilization properties.
- H. Planting Soil: Soil as defined in Section 02911 "Planting Soil for Modular Tree Cells" intended to fill the frames and other planting spaces.
- I. Root Barrier: Plastic root diversion device.
- J. Root package: The earthen package containing the root system of the tree as shipped from the nursery.
- K. Modular Tree Cells: Plastic structural cellular system with posts, beams and decks designed to be filled with planting soil for tree rooting and support of vehicle loaded pavements. The soil within the cells may also be used as part of rainwater filtering, retention and detention systems.
- L. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.
- M. Strongback: Modified modular tree cell frame designed to be attached to top of modular tree cells for stability while installing planting soil and backfill.
- N. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- O. Tree: A perennial woody plant with one or several trunks and a distinct crown and intended to become large enough to shade people and or vehicles.

#### 1.4 SUBMITTALS

- A. Prior to ordering materials, the Contractor shall provide submittals required in this section to the Engineer/Owner for review and approval.
- B. Product Data: For each type of product, submit manufacturer's product literature with technical data sufficient to demonstrate that the product meets these specifications.
- C. Samples for Verification: For each product where noted in the specification, submit samples as described.
- D. Soil Installation Mock Up and Compaction Evaluation:
  - 1. Prior to the installation of modular tree cells, construct a mock up of the complete installation at the site. The installation of the mock up shall be in the presence of the Engineer.
  - 2. The mock up shall be a minimum of 100 square feet in area and include the complete modular tree cell system installation with subbase, drainage installation, base course aggregate and geotextile as required, geogrids, backfill, planting soil with compaction, decks, and top geotextile.

3. The mock up area may remain as part of the installed work at the end of the project provided that it remains in good condition and meets all the conditions of the specifications.
- E. Compaction testing results: Submit results of all compaction testing required by the specifications including the bulk density test of the mock up and installed soil, and the compaction testing log of penetrometer and moisture meter readings to the Engineer for approval.
  - F. Qualification Data: Submit documentation of the qualifications of the modular tree cell installer sufficient to demonstrate that the installer meets the requirements of paragraph "Quality Assurance".
  - G. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
    1. Manufacturer's certified analysis for 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.
    3. Modular tree cell manufacturer's letter of review and approval of the project, plans, details and specifications for compliance with product installation requirements.

#### 1.5 SEQUENCING AND SCHEDULING

- A. General: Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.
- B. Schedule all utility installations prior to beginning work in this section.
- C. Where possible, schedule the installation of modular tree cells after the area is no longer required for use by other trades and work. Protect installed modular tree cells from damage in the event that work must occur over or adjacent to the completed modular tree cells.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Modular tree cells and related products shall be installed by a qualified installer whose work has resulted in successful installation of planting soils and planter drainage systems, underground piping, chambers and vault structures.
  1. Submit list of completed projects of similar scope and scale to the Owner, demonstrating capabilities and experience.
  2. The installer and the field supervisor shall have a minimum of five years successful experience with construction of similar scope in dense urban areas.

3. Installer's Field Supervision: Installer is required to maintain an experienced full-time supervisor on Project site when work is in progress. This person shall be identified during the Pre-installation Conference, with appropriate contact information provided, as necessary. The same supervisor shall be utilized throughout the Project, unless a substitution is submitted to and approved in writing by the Owner.

#### 1.7 LAYOUT AND ELEVATION CONTROL

- A. Provide layout and elevation control during installation of modular tree cells. Utilize grade stakes, benchmarks, surveying equipment and other means and methods to assure that layout and elevations conform to the layout and elevations indicated on the plans.

#### 1.8 PERMITS AND CODE COMPLIANCE

- A. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from all such authorities.

#### 1.9 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. Protect materials from deterioration during delivery and while on the project site.
- B. Bulk Materials: Do not deliver or place backfill, soils and soil amendments in frozen, wet, or muddy conditions.
  1. Do not dump or store bulk materials near structures, utilities, sidewalks, pavements, and other facilities, or on existing trees, turf areas or plants.
  2. Provide protection including tarps, plastic and or matting between all bulk materials and any finished surfaces sufficient to protect the finish material.
- C. Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.
- D. Modular tree cells: Protect modular tree cells from damage during delivery, storage and handling.
  1. Store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.

2. Handling is to be performed with equipment appropriate to the size (height) of cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, small cranes, etc., with care given to minimize damage to modular tree cell frames, decks and adjacent modular tree cells. Backhoes, front-end loaders and skid steers are considered inappropriate for modular tree cell transport and placement.

#### 1.10 PROJECT CONDITIONS

- A. Verification of Existing Conditions and Protection of New or Existing Improvements: Before proceeding with work in this section, the Installer shall carefully check and verify all dimensions, quantities, and grade elevations, and inform the Engineer immediately of any discrepancies.
  1. Carefully examine the Plans and UFPO markouts to become familiar with the existing underground conditions before digging. Verify the location of all aboveground and underground utility lines, infrastructure, other improvements, and existing trees, shrubs, and plants to remain including their root system, and take proper precautions as necessary to avoid damage to such improvements and plants.
  2. In the event of conflict between existing and new improvements notify the Engineer in writing and obtain written confirmation of any changes to the work prior to proceeding.
    - a. When new or previously existing utility lines are encountered during the course of excavation, notify the Engineer in writing and make recommendations as to remedial action. Proceed with work in that area only upon approval of appropriate remedial action. Coordinate all work with the appropriate utility contractors, utility company or responsible public works agency.
- B. Weather Limitations: Do not proceed with work when subgrades, soils and planting soils are in a wet, muddy or frozen condition.
- C. Protect partially completed modular tree cell installation against damage from other construction traffic when work is in progress, and following completion with highly visible construction tape, fencing, or other means until construction is complete. Prevent all non-installation related construction traffic over the completed modular tree cell installation; only allowing loads less than the design loads.

#### 1.11 PROTECTION

- A. Protect open excavations and partially completed modular tree cell installation from access and damage when work is in progress, and following completion with highly visible construction tape, fencing, or other means until all construction is complete.

#### 1.12 WARRANTY

- A. Modular tree cell manufacturer's product warranty shall apply. Submit manufacturer's product warranty.
- B. Warranty for other products and installation of modular tree cells in this section shall be as described in Division 1.

#### 1.13 PROJECT WORK

- A. Coordinate installation with all other work that may impact the completion of the work.

#### 1.14 PRECONSTRUCTION MEETING

- A. Prior to the start of the installation of modular tree cells, meet at the site with the Engineer, general contractor and the modular tree cells installer to review installation layout, procedures, means and methods.

### **PART 2 - PRODUCTS**

#### 2.1 MODULAR TREE CELLS

- A. Fiberglass-reinforced polypropylene structures including frames and decks designed to support sidewalk loads and designed to be filled with soil for the purpose of growing tree roots, and rainwater filtering, detention and retention.
- B. Modular Tree Cell Frames: 400 mm x 600 mm x 1200 mm (16 inches x 24 inches x 48 inches).
- C. Modular Tree Cell Deck: 5 cm x 600 mm x 1200 mm (2 inches x 24 inches x 48 inches). Deck to include manufactured installed galvanized steel tubes.
- D. Modular Tree Cell Strongback: 400 mm x 600 mm x 150 mm (24 inches x 48 inches x 6 inches) modified modular tree cell Frame units designed to stiffen and align the frames as planting soil and backfill material is placed. Strongbacks are to be removed prior to placing decks. They are to be reused as the work progresses.
- E. Modular Tree Cell Deck Screws: Manufacturer's supplied stainless steel screws to attach decks to frames.
- F. Product: Silva Cells, or Approved Equal.

Manufacturer: DeepRoot Partners, L.P. (Deep Root)

National Contact: 530 Washington St., San Francisco, CA 94111; Phone: 415.781.9700

Local Contact: Al Key, 19 West 21<sup>st</sup> St., Ste. 1003, New York, NY 10010

Phone: (212) 353-8788 (New York); Email: alkey@deeproot.com

Website: www.deeproot.com

2.2 ANCHORING SPIKES

- A. 10" (250 mm) long X 19/64" (8 mm) diameter, spiral, galvanized timber spikes. Utilize 4 nails in each frame on the first layer of modular tree cells to anchor the frames to the aggregate subbase.

2.3 SOLID AND PERFORATED DRAIN LINES

- A. See Section 02720 "Drainage Utilities".

2.4 OBSERVATION WELLS AND CLEANOUTS

- A. See Section 02720 "Drainage Utilities".

2.5 GEOGRID:

- A. Geogrid shall be from the following list of pre-approved products:
  - a. Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA, <http://www.tencate.com>
  - b. BX1500 Biaxial Geogrid as manufactured by Tensar International, Atlanta, GA, <http://www.tensar-international.com>
  - c. Fortrac 35 Geogrid as manufactured by Huesker, Charlotte, NC, <http://www.hueskerinc.com/>
  - d. SF 20 Biaxial Geogrid, as manufactured by Synteen, Lancaster, SC, <http://www.synteen.com>

2.6 GEOTEXTILE:

- A. See Section 02725 "Subsurface Infiltration Bed".

2.7 AGGREGATE SUBBASE (BELOW CELL FRAME):

- A. Aggregate below cell frame shall be uniformly graded, crushed No.2 stone as specified in the NYSDOT Standard Specifications 703-02, size designations from Table 703-4.

2.8 AGGREGATE BASE COURSE (ABOVE CELL DECK):

- A. Unless otherwise noted on the plans, aggregate above cell deck shall be a uniformly graded, crushed blend of No. 3A as specified in the NYSDOT Standard Specifications 703-02, size designations from Table 703-4.
- B. See plan details and Section 02630 – Unit Pavers and Section 02520 – PCC Sidewalks and Driveways for aggregate requirements beneath these pavements.

## 2.9 PLANTING SOIL

- A. See Specification Section 02911 - Planting Soil for Modular Tree Cells.

## 2.10 MULCH

- A. See Specification Section 02930 – Exterior Plants.

## 2.11 ROOT BARRIER

- A. Material: 0.080" wall thickness, nominal, injection molded 50% post-consumer recycled polypropylene panels with UV inhibitors.
  1. Integral molded 0.080" thickness by 2" deep vertical root directing ribs spaced at 6" O.C.
  2. 7/16" wide integral molded 0.080" thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
  3. Integral molded 0.080" thickness by 2" long by 3/8" wide horizontal anti-lift ground lock tabs; minimum nine per panel.
  4. Integrated zipper joining system for panel connection to adjacent panel.
  5. Size (each panel): 24" wide by 18" deep.
  6. Color: Black.
- B. Product: Tree Root Barrier UB 18-2 as manufactured by Deep Root, or Approved Equal.

## **PART 3 - EXECUTION**

### 3.1 LAYOUT APPROVAL

- A. Prior to the start of work, layout and stake the limits of excavation and horizontal and vertical control points sufficient to install the modular tree cells and required drainage features in the correct locations.

### 3.2 EXCAVATION

- A. Excavate to the depths and shapes indicated on the drawings. Base of excavation shall be smooth soil, level and free of lumps or debris.
- B. Do not over-excavate existing soil beside or under the limits of excavation required for the installation. If soil is over-excavated, install compactable fill material in lifts not more than 8 inches (200 mm) deep and compact to the required density.
- C. Confirm that the depth of the excavation is accurate to accommodate the depths and thickness of materials required throughout the extent of the excavation.
- D. Confirm that the width and length of the excavation is a minimum of 6 inches (150 mm), in all directions, beyond the edges of the modular tree cells.



### 3.3 SUBGRADE PREPARATION

- A. Subgrade below modular tree cell system shall be undisturbed and shall not be compacted for any reason. Light compaction is only permitted for leveling purposes only.
- B. Refer to Section 02725 – Subsurface Infiltration Bed for further description of equipment allowed on subgrade and subgrade preparation.

### 3.4 INSTALLATION OF GEOTEXTILE OVER SUBGRADE

- A. Where required, install geotextile over subgrade as shown on drawings.
- B. Install the geotextile with a minimum joint overlap of 18 inches (450 mm) between sections of material.
- C. Ensure geotextile is laid flat with no folds or creases. The modular tree cell frames must be installed on a flat surface.

### 3.5 INSTALLATION OF SOLID AND PERFORATED DRAIN LINES

- A. Refer to Section 02720 – Drainage Utilities.

### 3.6 INSTALLATION OF INSPECTION WELLS AND CLEANOUTS

- A. Install inspection wells and cleanouts to grade
  - 1. Install well base as shown on plans and extend wells into subbase aggregate.
  - 2. Cleanouts shall be installed at the planimetric corner of cells where gap allows the 6” diameter pipe.
  - 3. Where inspection wells are indicated to be placed on top of the modular tree cell deck, assemble well and fittings to dimensions required such that the rim of the well is flush with the paving. Set the rim top with a slope consistent with the slope of the pavement.
    - a. Adjust the location of the well such that the center of the well falls along the centerline of one of the ribbed sots in the deck. Cut the deck geotextile with an X cut and insert the well through the geotextile.
    - b. Make a geotextile collar secured to the well with zip ties that over lap the surrounding geotextile a minimum of 12-inches. Secure in place with tape.
  - 4. Brace all wells while backfill and paving is being installed to secure its location and elevation.
- B. Install cleanout caps on top of each top section flush to grade.

3.7 INSTALLATION Of AGGREGATE SUB BASE BELOW MODULAR TREE CELL FRAME

- A. Install aggregate sub base to the depths indicated on the drawings, under the first layer of modular tree cell frames.
- B. Compact aggregate sub base layer to a minimum of 95% of maximum dry density at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.
- C. Grade surface in a plane parallel to the grades of the paving above.  
The grade and elevations of the base under the modular tree cells shall be approved by the Engineer prior to proceeding with the installation of the modular tree cells.

3.8 INSTALLATION OF MODULAR TREE CELLS, PLANTING SOIL, GEOGRID, BACKFILL AND MULCH

- A. Identify the outline layout of the structure and the edges of paving around tree planting areas on the floor of the excavation, using spray paint or chalk line. The layout shall be calculated to include shift in layout locations due to depth and the slope of the cells.
- B. Lay out the first layer of modular tree cell frames on the sub base. Verify that the layout is consistent with the required locations and dimensions of paving edges to be constructed over the modular tree cells.
  - 1. Check each modular tree cell frame unit for damage prior to placing in the excavation. Any cracked or chipped unit shall be rejected.
- C. Place frames no less than 1 inch (25 mm) and no more than 3 inches (75 mm) apart.
- D. Assure that each frame sits solidly on the surface of the sub base. Frames shall not rock or bend over any stone or other obstruction protruding above the surface of the sub base material. Frames shall not bend into dips in the sub base material. The maximum tolerance for deviations in the plane of the sub base material under the bottom of the horizontal beams of each modular tree cell frame shall be 1/4 inch (6 mm) in 4 feet (1200 mm). Adjust sub base material including larger pieces of aggregate under each frame to provide a solid base of support.
- E. Anchor each modular tree cell into sub base with four-10 inch (250 mm) spikes, driven through the molded holes in the cell frame base. The purpose of the anchoring system is to maintain cell spacing and layout during the installation of planting soil and backfill.
  - 1. For applications where cells are installed over waterproofed structures, develop a spacing system consistent with requirements of the waterproofing system. Do not use anchoring nails that will come within 6" or less of any waterproofing material. Submit spacing system procedure for approval by the waterproofing provider.

- F. Install the second layer of modular tree cell frames on top of the first layer. Comply with manufacturer's requirements to correctly register and connect the cell frames together.
1. Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that connector tabs firmly connect. Each frame shall be solidly seated on the one below.
  2. Build layers as stacks of frames set one directly over the other. Do not set any frame half on one cell frame below and half on an adjacent frame.
- G. Install Strongbacks on top of the modular tree cell frames prior to installing planting soil and backfill.
1. Strongbacks are required only during the installation and compaction of the planting soil and backfill.
  2. Strongbacks should be moved as the work progresses across the installation.
  3. Strongbacks shall be removed prior to the installation of modular tree cell decks.
- H. Install planting soil, geogrid curtain and backfill as indicated on the drawings. The process of installation requires that these three materials be installed and compacted together in several alternating operations to achieve correct compaction relationships within the system.
- I. Where required, place the geogrid curtain along the outside of the limit of the modular tree cell frames.
1. Geogrid curtains are required between the edge of the modular tree cells and any soils to be compacted to support paving beyond the area of modular tree cells. Do not place geogrid curtains between the edge of the cells and any planting area adjacent to the cells.
  2. Pre-cut the geogrid to allow for 6 inches (150 mm) minimum under lapping below backfill, and 12 inches (300 mm) minimum overlapping top of modular tree cell stack.
  3. Where cell layout causes a change direction in the plane of the geogrid, slice the top and bottom flaps of the material so that it lies flat on the top of the cell deck and aggregate base course along both planes.
  4. Provide a minimum of 300 mm (12 inch) overlaps between different sheets of geogrid.
  5. Place the geogrid in the space between the modular tree cell frames and the sides of the excavation. Attach the geogrid to the modular tree cell frames using 3/16 inch x 12-inch (5x300 mm) zip ties. Attach with zip ties at every cell and at cell deck.

- J. Install no more than two layers of modular tree cell frames before beginning to install planting soil and backfill. Compact the planting soil within the modular tree cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both soils.
- K. Install and compact backfill material in the space between the modular tree cells and the sides of the excavation in lifts that do not exceed 8 inches (200 mm).
1. Compact backfill to 95% of maximum dry density using a powered mechanical compactor. Use a pneumatic compacting tool or narrow foot jumping jack compactor for spaces less than 12 inches (300 mm) wide and a 12-inch wide jumping jack compactor or larger equipment in wider spaces.
  2. Maintain the geogrid curtain between the modular tree cells frames and the backfill material.
  3. Install backfill in alternating lifts with the planting soil inside the modular tree cells.
- L. Fill the first layer or layers of frames with planting soil, specified in Section 02911 "Planting Soil". Install in lifts that do not exceed 8 inches (200 mm). Lightly compact the soil inside the frames at each lift to remove air pockets and settle the soil within the frames.
1. Do not compact greater than 85% of maximum dry density. Check the soil compaction with a penetrometer or densiometer to achieve similar compaction levels provided in the mock up.
  2. If the planting soil becomes overly compacted, remove the soil and reinstall. Use hand tools or other equipment that does not damage the modular tree cell frames.
  3. Do not walk directly on horizontal beams of the frames.
  4. Work soil under the horizontal frame beams of the second level of cell frames and between columns eliminating air pockets and voids. Fill each frame such that there is a minimum of 10 inches (250 mm) of soil over the top of horizontal frame beams before beginning compaction.
  5. The top 1-2 inches (25-50 mm) of each frame post should remain exposed above the soil to allow the placement of the next frame or deck.
- M. After the first two layers of modular tree cell frames have been installed, filled with planting soil and backfilled, proceed to install the third layer, if required, of modular tree cells frames. Comply with manufacturer's requirements to correctly register and connect the cell frames together.
1. Remove the strongbacks. Sweep any soil from tops before adding the next layer of frames.
  2. Register each frame on top of the lower frame post. Rotate each frame registration arrow in the opposite direction from the frame below to assure that

connector tabs firmly connect. Each frame shall be solidly seated on the one below.

3. Build layers as stacks of frames set one directly over the other. Do not set any frame half on one cell frame below and half on an adjacent frame.
- N. Install Strongbacks on top of third layer of modular tree cells.
- O. Continue to install and compact the planting soil within the modular tree cell frames and the backfill material outside the frames in alternating lifts until the desired elevations and density is achieved in both soils.
1. When using mulch, add a final layer of planting soil as required to bring the planting soil level to not more than 3 inches (75 mm) below the bottom of the modular tree cell deck when installed. When using air space rather than compost, the planting soil shall be brought to level not more than 1 inch (25 mm) below the bottom of the modular tree cell deck when installed.
  2. Obtain final approval by the Engineer of soil installation prior to installation of the modular tree cell deck.
- P. Remove Strongbacks after planting soil and backfill has been compacted to the top of the entire set of modular tree cells.
- Q. Install 3 inches (75 mm) of mulch, or leave 1-inch (25 mm) air space, below modular tree cell deck as indicated on the drawings.

### 3.9 MODULAR TREE CELL DECK INSTALLATION

- A. Install the modular tree cell decks over the top of each frame stack. Clean dirt from the tops of the modular tree cell frame columns. Register the deck and make connections as recommended by the manufacturer to secure the deck to the top of the modular tree cell frame. Secure each deck at the four corners with screw fasteners as recommended by the manufacturer. Assure that each deck is seated firmly on the frame top with all connectors attached.
- B. Install and compact remaining backfill material such that the soil outside the limits of the modular tree cells is flush with the top of the installed deck.

### 3.10 INSTALLATION OF GEOTEXTILE, GEOGRID, INSPECTION WELL AND AGGREGATE OVER THE DECK

- A. Overlap geogrid over the top of the modular tree cell decks, with minimum of 12 inches (300mm) overlap.
- B. Place geotextile over the top of the deck and where indicated on the drawings, extending beyond the outside edge of the excavation by at least 18 inches (450 mm). Any joints must be overlapped by a minimum of 18 inches (450 mm).

- C. Cut geotextile a minimum of 20 percent larger than the size of the deck area to be covered to accommodate for required conforming of the geotextile and stone to the deck contours.
- D. Install inspection wells and cleanouts above geotextile.
- E. Install the aggregate base course (including aggregate setting bed if installing unit pavers) over the geotextile immediately after completing the installation of the fabrics and inspection wells. Work the aggregate from one side of the deck to the other to assure that the fabric and aggregate conforms to the cell deck contours. Do not apply aggregate in several positions at the same time.
  - 1. Load the aggregate from equipment that is outside the limits of the excavated area. Use small, low impact material mover such as a concrete buggy or Georgia Buggy to move aggregate over the cells. Work over material already in place. Never allow any motorized equipment of any size to operate directly on the modular tree cell deck.
  - 2. For large or confined areas, where aggregate cannot easily be placed from the edges of the excavated area, obtain approval for the installation procedure and types of equipment to be used in the installation from the modular tree cell manufacturer.
  - 3. Compact aggregate base course(s) in lifts as noted in pavement and infiltration bed specifications.

### 3.11 INSTALLATION OF PAVING ABOVE THE MODULAR TREE CELL SYSTEM

- A. Place paving material over modular tree cell system as specified elsewhere in the specifications.

### 3.12 INSTALLATION OF ROOT BARRIERS

- A. Install root barrier in accord with manufacturer's reviewed installation instructions.
- B. Install with vertical root directing ribs facing inwards towards trees or plants.
- C. Connect panels together as required with manufacturer's standard joining system.

### 3.13 INSTALLATION OF PLANTING SOIL AND MULCH WITHIN THE TREE PLANTING AREA

- A. Prior to planting trees, install additional planting soil, to the depths indicated, within the tree opening adjacent to paving supported by modular tree cells.
- B. Remove all rubble, debris, dust and silt from the top of the planting soil that may have accumulated after the initial installation of the planting soil within the modular tree cells.

- C. Assure that the planting soil under the tree root ball is compacted to approximately 85-90% to prevent settlement of the root ball.
- D. The planting soil within the tree opening shall be the same soil as in the adjacent modular tree cells.
- E. Cover the planting soil finished grade with 2 inches (50 mm) of mulch.

#### 3.14 REPAIR OF CUT GEOTEXTILE

- A. In the event that any geotextile over subgrades or the modular tree cell decks must be cut during or after installation, repair the seam with a second piece of geotextile that overlaps the edges of the cut by a minimum of 12-inches in all directions prior to adding aggregate material.

#### 3.15 PROTECTION

- A. Ensure that all construction traffic is kept away from the limits of the modular tree cells until the final surface materials are in place. No vehicles shall drive directly on the modular tree cell deck or aggregate base course.
- B. Provide fencing and other barriers to keep vehicles from entering into the area with modular tree cell supported pavement.
- C. Maintain a minimum of 4 inches (100 mm) of aggregate base course over the geotextile material during construction.
- D. When vehicle must cross modular tree cells that does not have final paving surfaces installed, use construction mats designed to distribute vehicle loads to levels that would be expected at the deck surface once final paving has been installed. Use only low impact track vehicles with a maximum surface pressure under the vehicle of 4 pounds per square inch, on top of the mats over modular tree cells prior to the installation of final paving.

#### 3.16 CLEAN UP

- A. Perform cleanup during the installation of work and upon completion of the work. Maintain the site free of soil and sediment, free of trash and debris. Remove from site all excess soil materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

**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 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 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 02517 - GRANITE TRANSITION CURB (5")**

### **PART 1 - GENERAL**

#### **1.01 DESCRIPTION**

- A. Under this item the Contractor shall furnish and install granite curb transition where shown on the plans or as directed by the Engineer. This item is intended for transition from sixteen inch (16") curb to twelve inch (12") curb at driveways and handicapped access ramps.

### **PART 2 – PRODUCTS**

#### **2.01 MATERIALS**

- A. The transition curb shall have an approximate depth of sixteen inches (16") at one end and taper to a depth of approximately twelve inches (12") at the other end. The length of the curbstone shall be a minimum of twenty-four inches (24") at driveways and a minimum of five feet (5') ± 3" at handicapped access ramps. It shall have a minimum width on top of five inches (5") and a minimum width on bottom of four inches (4") for not less than two-thirds (2/3) of the length of stone.
- 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/ft<sup>2</sup>                      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 02522 – PORTLAND CEMENT CONCRETE CURBS**

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. Under these items the Contractor shall construct Portland Cement Concrete Curbs as shown on the plans or as directed by the Engineer.

### 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, Type II	701-01
Coarse Aggregates	703-02
Concrete Sand	703-07
Admixtures	711-08
Water	712-01

- B. Concrete for curbs shall comply with the requirements for Class A concrete, as defined in the aforementioned NYSDOT Standard Specifications, Section 501.

### PART 3 – EXECUTION

#### 3.01 CONSTRUCTION DETAILS

- A. Excavation
  - 1. Existing deteriorated concrete shall be removed and disposed off the line of work to the satisfaction of the Engineer.
- B. Subgrade
  - 1. The subgrade shall be dressed to a plain surface containing no large stones, roots, sod or rubbish.
  - 2. 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 and as shown on the drawings.
- C. Formwork
  - 1. Forms shall be of lumber with nominal thickness of two (2") inches, or of steel of

equal rigidity and strength. Forms shall be free of warp and of such construction that there will be no interference to inspection for grade and alignment. All forms shall extend to the full depth of the curb and be secured so that no displacement will occur during placement of concrete. All forms shall be properly cleaned and wood forms shall be thoroughly wetted, and metal forms oiled, before depositing any material against them.

2. Curbs shall be cast in segments having a uniform length of approximately 10 feet. The joints between segments shall not exceed 1/4 inch in width.
3. Expansion joints shall be 11/16 inches wide and contain Premolded Resilient Joint Filler as specified in Section 705-07 of the NYSDOT Standard Specifications.

D. 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-five (45°) degrees Fahrenheit, except with written permission of the Engineer.
2. Concrete shall be compacted with an immersion type mechanical vibrator.

E. 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 curb. The front form may be removed before the other forms in order to facilitate finishing the curb and removal of the joint dividers.
2. All concrete curbs 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.
3. 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-five (45°) degrees Fahrenheit to obtain specified concrete strengths.

F. 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 curbs.
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. Sections of curb for which 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 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 02525 – EMBEDDED PREFORMED DETECTABLE WARNING UNITS (NEW)

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. Under this payment item, the Contractor shall furnish and install embedded, preformed detectable warning units concurrently with newly installed sidewalk curb ramps and other locations, as shown on the plans, standard sheets, or as ordered by the Engineer.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. The Manufacturer of the detectable warning units shall supply certification to the Engineer that its product meets the requirements of these specifications. Detectable warnings surface materials shall:

1. Meet the requirements of the Construction Details,
2. Be composed of cementitious material, clay or shale, plastics, polymeric materials, resins, or pigments.
3. Have a minimum unit size of 12” x 12”.
4. Be an approximate visual match to the color specified, and be uniform in color and texture.
5. Have a good appearance, free of cracks or other defects.
6. Have clean-cut and well defined edges.
7. Be weather resistant and durable to normal pedestrian wear and maintenance activities.
8. Show no appreciable fading, lifting, or shrinkage.
9. Have friction characteristics similar to that of broomed Portland cement concrete (PCC).
10. Compressive Strength, Min., 28 days, of 7977 psi.
11. Freeze-thaw Loss (25 Cycles, one per day, 10% NaCl solution) of 1.0%.

- B. Color

1. The color of the detectable warning units shall visually contrast with the immediately adjacent curb ramp and sidewalk material. When the color of the adjacent curb ramp and sidewalk material is that of typical, uncolored, concrete, the color of the detectable warning surface shall be **Brick Red, Federal Standard Number 22144**.
2. If the immediately adjacent curb ramp and sidewalk material is NOT that of typical, uncolored, concrete, the color of the detectable warning surface shall be determined by the Engineer.

- C. The following are products approved:

<u>Product Name</u>	<u>Manufacturer</u>
Step-Safe Precast Polymer Concrete Tactile Dome Safety Tile	Transpo Industries New Rochelle, NY 10801
Armor-Tile Cast-in-place Panels	Engineered Plastics, Inc. Williamsville, NY 14221

D. In order for other material products to be approved as equal by the Engineer, the Contractor shall submit two sets of the following to the Engineer at least 30-days prior to the proposed installation displaying the following information:

1. A minimum 12 inch x 12 inch sample of the detectable warning surface material,
2. All associated product material literature,
3. Preparation and Installation Requirements,
4. Equipment required for installation,
5. Name(s) of suppliers.

OR

6. The manufacturer shall demonstrate in writing and provide references that the detectable warning unit has been satisfactorily used for roadway, or sidewalk curb ramp applications. Further, this use shall have been in locations exposed to high pedestrian traffic, and under weather conditions similar to those experienced in central New York State, for a minimum period of five years.

### PART 3 – EXECUTION

#### 3.01 CONSTRUCTION DETAILS

- A. Under this item, the Contractor shall install the detectable warning units in accordance with the NYSDOT Standard Detail Sheets M608-3R3 and M608-5R2.
- B. Preformed, embedded detectable warning units may be installed in plastic concrete, inlaid on prepared concrete surfaces, or as otherwise recommended by the Manufacturer.
- C. The subgrade shall be that portion of the ground surface directly beneath the sidewalk slab. 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. 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. The detectable warning field shall be constructed in such a manner that no detectable warning unit, when cut in order to fit as determined by the Engineer, **is less than 36 square inches in area.**
- E. The detectable warning units shall be installed to be flush with the surrounding concrete.
- F. Follow all applicable material supplier's and manufacturer's requirements for environmental conditions, surface preparation, installation procedures, curing procedures, and materials compatibility.

### 3.02 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 02610 - ASPHALT MILLING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Under this item the Contractor shall perform cold-planing/milling and removal of asphalt pavements in accordance with the plans or as directed by the Engineer.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

1.1 EQUIPMENT

- A. The equipment for grinding and profiling pavement surface shall be a power-operated, planing machine or grinder capable of removing in one pass, a thickness of asphaltic concrete necessary to provide profile, cross-slope, and desired texture uniformly across the entire pavement surface up to seven (7) inches in one pass.
- B. The equipment shall be self-propelled with sufficient power, traction, and stability to maintain accurate depth of cut and slope.
- C. The equipment shall have be capable of controlling the chunk size to meet the following gradation:

<u>Sieve Size</u>	<u>Chunk Size Gradation</u>	<u>Percent Passing</u>
3"		100
2"		95-100
#200		0-12

- D. In addition, the machine shall be so designed that the drum is capable of cutting with a zero side clearance on at least one side.
- E. The reclaimed material will be discharged to the rear of the machine onto a 24" pick-up conveyor belt. This conveyor will transfer material to a minimum of 24" wide truck loading conveyor.
- F. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine (within  $\pm 1/8"$ ) by referencing from the exiting pavement by means of a ski matching shoe or from an independent grade control and shall be controlled by an automatic system for controlling grade elevation and cross slope at a given rate.
- G. The machine shall be equipped with means to control dust and other particulate matter created by the cutting action.
- H. Machine shall be variable in order to leave the desired grid pattern surface texture.

- I. Determination of the type carbide milling teeth shall be the sole discretion of the using agency if the intended milling is to be used as a serviceable riding texture for an indeterminate time.
- J. The Contractor shall provide sufficient equipment to remove the millings from the pavement at the same rate as the milling operation.

## 1.2 PLANING/MILLING AND REMOVAL

- A. The paving surface shall be removed to a depth as shown on plans, and to a width, grade, and cross-section as shown on plans, or as directed by the Engineer.
- B. The work involved corresponds to the Asphalt Recycling and Reclaiming Association's designation of Class II Cold Planing, in which pavement is removed to a specified uniform depth. Milling a wedge cut along the curb line to a specified cross slope will also be required.
- C. The surface resulting from the milling operation shall be in accordance with the plan and specification grades, and shall be characterized by uniform discontinuous longitudinal striations or other uniform pattern and shall not be gouged or torn.
- D. Before opening the milled surface to traffic, all loose material shall be removed from the milled surface and the surface swept with a power broom.
- E. In the event the entire pavement width along a section of highway has not been planed to a flush surface by the end of a work period, resulting in a vertical or near vertical longitudinal face exceeding 1-1/4" in height, this longitudinal face shall be sloped in a manner acceptable to the Engineer as not to create a hazard to traffic. If the road is to be open to traffic, vertical drop-offs in excess of two (2) inches at a lane line or at a centerline shall not be left overnight.
- F. Transverse faces existing at the end of a work period should be tapered in a manner approved by the Engineer to avoid a hazard for traffic.
- G. A reference elevation and string line shall be maintained by the Contractor to assure the proper subgrade. This shall be approved by the Engineer.
- H. Asphaltic concrete that cannot be removed by cold-planing equipment because of physical or geometrical restraints should be removed by other methods acceptable to the Engineer.
- I. Protect existing structures as indicated on the plans or as directed by the Engineer.
- J. Repair any pre-existing pavement base failures uncovered by the Contractor's milling operation, or as direct by the Engineer.

## 1.3 MILLED MATERIAL HAULING AND DISPOSAL

- A. Milled material shall be hauled offsite to a location of the Contractor's choosing. If desire, the Contractor may haul to the Department of Public Work's Asphalt Plant at 1200 Canal Street, Syracuse, and unload at the foot of the designated stockpile. DPW personnel will stack the milled material into the stockpile. The Engineer may order stockpiling at another site within city limits at no additional cost.

- B. If the Contractor chooses to haul milled material to the DPW, because the milled material is scheduled for recycling, it is imperative that it be free of any debris. The City reserves the right to reject any milled material that contains newspapers, paper bags, styrofoam, cans, wood, soil, or any other debris not found within the pavement structure. The City also reserves the right to reject any milled material that does not meet the gradation size specified above. Any material deemed unacceptable by the City shall be weighed on the truck scale located at the DPW asphalt plant and the weight applied toward a deduction to the Contractor's payment, based on a rate of 10 square yards of 3" milling material per 1.5 tons of rejected material. Weight tickets shall be given for all rejected material. The Contractor shall be responsible for the disposal of rejected milled material.

**END OF SECTION**

## SECTION 02630 - UNIT PAVERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Brick pavers set in aggregate setting beds.
  - 2. Plastic and steel edge restraints.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Samples for unit pavers and edge restraints.
  - 1. Include similar samples of material for joints and accessories involving color selection.
- C. Samples for Verification: Full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed at least five (5) paver installations similar in material, design, and extent to that indicated for this Project within the past three (3) years and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- C. Mockups: Before installing, build mockups for each form and pattern of clay pavers and bluestone required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, and contiguous work as indicated:
  - 1. Build 8'x8' pavement mockups in the location indicated or, if not indicated, as directed by Engineer.

2. Notify Engineer seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects.
4. Obtain Engineer's approval of mockups before starting unit paver installation.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect clay pavers and bluestone and aggregate during storage and construction against soiling or contamination from earth and other materials.
  1. Cover clay pavers and bluestone with plastic or use other packaging materials that will prevent rust marks from steel strapping.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp

#### 1.5 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or build on frozen subgrade or setting beds. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

### PART 2 - PRODUCTS

#### 2.1 UNIT PAVERS

- A. Clay Pavers: English Edge clay pavers as distributed by Pine Hall Brick or equal approved by Engineer. Pavers shall meet the following requirements set forth in ASTM C 902, Specification for Pedestrian and Light Traffic Paving Brick or C1272 Specification for Heavy Vehicular Paving Brick and shall conform to the PX standard. Provide brick without frogs or cores in surfaces exposed to view in the completed work.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
    - a. Pine Hall Brick  
PO BOX 1104  
2701 Shorefair Drive  
Winston Salem, NC 27116-1044  
Phone: (800)334-8689  
Web: [www.pinehallbrick.com](http://www.pinehallbrick.com)
  2. Thickness: 2-3/4"



3. Face Size: 4 by 8 inches (102 by 203 mm)
4. Color: As selected by Architect from manufacturer's full range.

B. Concrete Pavers: Prest Paver as distributed by Hanover Architectural Products, Inc or equal approved by Engineer. Pavers shall meet the following requirements set forth in ASTM C 902, Specification for Pedestrian and Light Traffic Paving Brick or C1272 Specification for Heavy Vehicular Paving Brick and shall conform to the PX standard. Provide brick without frogs or cores in surfaces exposed to view in the completed work.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - a. Hanover Paver  
240 Bender Road  
Hanover, PA 17331  
Phone: (717) 637-0500 or (800) 426-4242  
Fax : (717) 637-7145  
Email : info@hanoverpavers.com
2. Thickness: 2-3/4"
3. Face Size: 8 inches by 8 inches (203 by 203 mm)
4. Color: As selected by Architect from manufacturer's full range
5. Finish: As selected by Architect from manufacturer's full range

## 2.2 EDGE RESTRAINTS

A. Plastic Edge Restraints: Manufacturer's standard triangular PVC extrusions 1-3/4 inches (45 mm) high by 3-1/2 inches (89 mm) wide designed to serve as edge restraints for unit pavers; rigid type for straight edges and flexible type for curved edges, with pipe connectors and 3/8-inch (9.5-mm) diameter by 12-inch- (300-mm-) long steel spikes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Pave Tech Inc.
  - b. Brickstop Corporation.
  - c. Dimex Corporation.
  - d. Oly-Ola Edgings, Inc

B. Steel Edge Restraints: Manufacturer's standard painted steel edging 3/16 inch (4.8 mm) thick by 4 inches (100 mm) high with loops pressed from or welded to face to receive stakes at 36 inches (900 mm) o.c., and steel stakes 15 inches (380 mm) long for each loop.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Border Concepts, Inc.
  - b. Collier Metal Specialties, Inc.
  - c. J. D. Russell Company (The).
  - d. Sure-loc Edging Corporation.

2. Color: As selected by Architect from manufacturer's full range

### 2.3 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

### 2.4 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 57.
- B. Stone Screenings leveling Course: Provide setting bed materials complying with one of the following:
  1. Sand: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
    - a. For sand setting bed less than 1 inch thick, comply with ASTM C 144.
  2. Stone Screenings: Sound stone screenings complying with ASTM D 448 for Size No. 10.
- D. Stone screenings for Joints: Provide joint materials complying with one of the following:
  1. Sand: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
  2. Stone screenings or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.
- C. Drainage Geotextile: See Section 02725 – Subsurface Infiltration Bed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

- C. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable. Use full units without cutting where possible.
- D. Joint Pattern: As indicated on drawings
- E. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
- G. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
  - 1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
  - 2. Before ending each day's work, fully compact installed pavers to within 36 inches (900 mm) of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.
- H. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase for clay pavers and bluestone.
- I. Place geotextile over prepared subgrade overlapping ends and edges at least 12 inches
- J. Place leveling course and screed depth indicated, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
- K. Joint fill per paver type.

### 3.3 AGGREGATE SETTING-BED APPLICATIONS

- A. Place drainage geotextile over compacted subbase courses, overlapping ends and edges at least 12 inches (300 mm).
- B. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25-38 mm), taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- C. Set pavers hand tight with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
- D. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500 to 5000 lbf compaction force at 80 to 90 Hz.

- E. Spread dry stone screenings and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add stone screenings until joints are completely filled, then remove excess sand. Leave a slight surplus of stone screenings on the surface for joint filling. Do not allow traffic on installed pavers until stone screenings has been vibrated into joints.
- F. Repeat joint-filling process 30 days later

#### 3.4 REPAIR, POINTING, CLEANING, AND PROTECTION

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

#### 3.5 Cleaning: Clean and protect paving from adjacent sitework operations

**END OF SECTION 02630**

## SECTION 02631 – POROUS UNIT PAVERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid concrete pavers with openings between pavers filled with aggregate
2. Aggregate setting bed for pavers

#### 1.2 ACTION SUBMITTALS

A. Product Data: For materials other than water and aggregates.

B. Sieve Analyses: For aggregate materials, according to ASTM C 136.

C. Samples:

1. Full-size units of each type of unit paver indicated.
2. Exposed edge restraints.
3. Aggregate fill.
4. Aggregate setting bed materials.

D. Samples for Verification: Full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

#### 1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed at least five (5) paver installations similar in material, design, and extent to that indicated for this Project within the past three (3) years and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Mockups: Before installing, build mockups for each form and pattern of clay pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and

qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, and contiguous work as indicated:

1. Build 8'x8' pavement mockups in the location indicated or, if not indicated, as directed by Engineer.
2. Notify Engineer seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects.
4. Obtain Engineer's approval of mockups before starting unit paver installation.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect clay pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.
  1. Cover clay pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp

#### 1.5 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or build on frozen subgrade or setting beds. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

### PART 2 - PRODUCTS

#### 2.1 POROUS UNIT PAVERS

- A. Clay Pavers: StormPave as distributed by Pine Hall Brick, or equal approved by Engineer. Pavers shall meet the following requirements set forth in ASTM C 902, Specification for Pedestrian and Light Traffic Paving Brick or C1272 Specification for Heavy Vehicular Paving Brick and shall conform to the PX standard. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - a. Pine Hall Brick  
PO BOX 1104  
2701 Shorefair Drive

Winston Salem, NC 27116-1044  
 Phone: (800)334-8689  
 Web: www.pinehallbrick.com

2. Thickness: 2-3/4"
3. Face Size: 4 by 8 inches (102 by 203 mm)
4. Color: As selected by Architect from manufacturer's full range
5. Style: English Edge to match non-porous unit pavers.

## 2.2 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Per Specification 02725 – Subsurface Infiltration Bed.
- B. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57, or in lieu of ASTM No. 57 base described below, an acceptable alternative is uniformly graded, crushed blend of 40 percent No.1 and 60 percent No.2 stone as specified in the NYSDOT Standard Specifications 703-02, size designations from Table 703-4.
- C. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8
- D. Graded Aggregate for Porous Paving Fill: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8
- E. Nonwoven Geotextile: See Specification 02725 – Subsurface Infiltration Bed.
- F. Joint/opening filler, bedding, and base: conforming to ASTM D 448 gradation as shown in Tables 1 and 2 below

**Table 1**  
**Grading Requirements for ASTM No. 8 Bedding and Joint/Opening Filler**

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	85 to 100
4.75 mm (No. 4)	10 to 30
2.36 mm (No. 8)	0 to 10
1.16 mm (No. 16)	0 to 5

**Table 2**  
**Grading Requirements for ASTM No. 57 Base**

Sieve Size	Percent Passing
37.5 mm (1 1/2 in.)	100
25 mm (1 in.)	95 to 100
12.5 mm (1/2 in.)	25 to 60
4.75 mm (No. 4)	0 to 10
2.36 mm (No. 8)	0 to 5

**Table 3**  
**Grading Requirements for ASTM No. 2 Sub-Base Aggregates**

Sieve Size	Percent Passing
3"	100
2-1/2"	90 to 100
1-1/2"	35 to 70
1"	0 to 15
2.36 mm (No. 8)	0 to 5

G. Gradation criteria for the bedding and base:

1. D15 base stone /D50 bedding stone < 5.
2. D50 base stone/D50 bedding stone > 2.

F. Provide accessory materials as follows:

1. Edge Restraints with Granular Subbase Anchoring System

a. Product: PermEdge, or Approved Equal

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable. Use full units without cutting where possible.
- D. Joint Pattern: As indicated on drawings
- E. Tolerances:
  1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch (1.5-mm) unit-to-unit offset from flush.



2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) or a maximum of 1/2 inch (13 mm).
- F. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
  2. Before ending each day's work, fully compact installed pavers to within 36 inches (900 mm) of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.
- G. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase for clay pavers and bluestone.
- G. Place geotextile over prepared subgrade overlapping ends and edges at least 12 inches
- H. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

### 3.3 AGGREGATE SETTING-BED APPLICATIONS

- A. Place drainage geotextile over leveled subgrade, overlapping ends and edges at least 12 inches (300 mm).
- B. Place aggregate subbase
1. Moisten, spread and compact No. 57 base in 76 mm (3 in.) lift over the compacted subgrade with a minimum 10 T (10 t) vibratory roller until there is no visible movement of the No. 57 stone. Do not crush aggregate with the roller.
  2. The surface tolerance the compacted No. 57 base should not deviate more than.  $\pm 25$  mm ( $\pm 1$  in.) over a 3 m (10 ft.) straightedge.
- C. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm) taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

### 3.4 PAVER INSTALLATION

- A. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.
- B. As work progresses, remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

- C. Repeat joint-filling process 30 days later

### 3.5 REPAIR, POINTING, CLEANING, AND PROTECTION

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Cleaning: Clean and protect paving from adjacent sitework operations.

**END OF SECTION 02631**

## 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), 19<sup>th</sup> 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.

- 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 02651 – PAVEMENT MARKINGS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. The work of this Section includes striping paint pavement markings to be applied at various locations as shown in the plans.

#### **1.2 SUBMITTALS**

- A. All submittals shall be submitted to Engineer for review and approval a minimum of two weeks prior to pavement construction.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

##### **A. Striping Paint**

1. Striping paint shall be chlorinated rubber base, factory mixed, non-bleeding, fast drying, best quality, white traffic paint with a life expectancy of two years under normal traffic use.
2. Paint shall be latex, water-based emulsion, ready-mixed, complying with PS TT-P-1952.
3. Color: White
4. Color for Handicapped Markings, if required: Blue

### **PART 3 - EXECUTION**

#### **3.1.1 INSTALLATION**

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Paint traffic lane striping in accordance with layouts of plan. Striping width shall be as shown on the plans. Apply paint with mechanical equipment to produce uniform straight edges. Apply in two coats at manufacturer's recommended rates. Provide clear, sharp lines.

**END OF SECTION**



## SECTION 02720 – DRAINAGE UTILITIES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This work includes the construction of catch basins, solid and perforated stormwater piping, and other structures as shown on the plans, as well as any incidental or related operations.

#### 1.2 SUBMITTALS

- A. Submit three copies of catalogue cuts of all fabricated materials, including pipes, precast structures, grates, etc. for approval by the Engineer/Owner prior to ordering.
- B. Submit shop drawings as specified to Engineer/Owner for approval prior to ordering.

#### 1.3 QUALITY ASSURANCE

- A. 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.
- 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), 19<sup>th</sup> 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.

#### 1.4 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. SDR 35 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 if 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. Observation Wells and Cleanouts

1. Inspection risers and cleanouts shall consist of a rigid, schedule 40 non-perforated PVC pipe, 4 inches in diameter (observation wells) and 6 inches in diameter (cleanouts). Cut slots in the bottom of wells to allow water access for inspection risers that extend to the sub base aggregate.
2. Cap shall be PVC with ductile iron cover and encasement/adjacent pavement as noted on the plans.

E. 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.

F. 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.

G. 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

H. 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 02725 – SUBSURFACE INFILTRATION BED

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. The work of this Section includes subgrade preparation and installation of a subsurface infiltration bed.

#### 1.2 SUBMITTALS

- A. Submit a list of materials proposed to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.
- B. Submit certificates, signed by the materials producer, stating that materials meet or exceed the specified requirements.

#### 1.3 QUALITY ASSURANCE

- A. 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 the methods needed for proper performance of the work in this Section.
- B. Codes and Standards
  - 1. All materials, methods of construction and workmanship shall conform to applicable requirements of NYSDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

#### 1.4 PROJECT CONDITIONS

- A. Protection of Existing Site
  - 1. Do not damage or disturb existing site features, utilities, or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
  - 2. Restore damaged site features, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Owner, and authority having jurisdiction at no additional cost.
- B. Safety and Traffic Control
  - 1. Notify and cooperate with local authorities and other organizations having jurisdiction (such as NYSDOT and/or City of Syracuse) when construction work will interfere with existing roads and traffic.
  - 2. Provide temporary barriers, signs, warning lights, flagmen, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.
- C. Erosion and Sediment Control Measures

1. All erosion and sediment measures must be installed prior to infiltration bed construction and maintained throughout project construction.
2. It is the contractor's responsibility to maintain job conditions to prevent the deposition of sediment on infiltration beds by wind-borne deposition, tracking, stormwater runoff, etc.
3. If job conditions arise that adversely affect the infiltration bed, additional measures such as access control during construction, vacuuming of impervious and pervious surfaces, or additional site stabilization may be required.

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), 19<sup>th</sup> 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregates within infiltration bed shall be clean and thoroughly washed and shall meet the following:
1. Maximum Wash Loss of 0.5% (ASTM C117)
  2. Minimum Durability Index of 35 (ASTM D3744)
  3. L.A. abrasion loss, 30% maximum. (ASTM C131 and C535)
  4. Aggregate shall be 100% crushed material.
  5. Fractured Faces, 1 side 95% minimum, 2 sides 90% minimum (ASTM D5821).
- B. Unless otherwise noted on the plans or approved by the Engineer, coarse aggregate for the infiltration bed shall be uniformly graded, crushed and washed No. 3A stone as specified in the NYSDOT Standard Specifications 703-02, size designation from Table 703-4.
- C. Unless otherwise noted on the plans or approved by the Engineer, choker base course aggregate for infiltration beds beneath pavements shall be a uniformly graded, crushed blend of 40 percent No.1 and 60 percent No.2 stone as specified in the NYSDOT Standard Specifications 703-02, size designations from Table 703-4.
- D. Unless otherwise noted on the plans or approved by the Engineer, NYSDOT Select Granular Subgrade for infiltration beds shall be as specified in the NYSDOT Standard Specifications 203-2, size designations from Part 203-2.02.C.1.
- E. Non-woven geotextile (drainage filter fabric) shall conform to the following:
1. Minimum flow rate of 110 gal/min/ft<sup>2</sup> ASTM D-4491-99A
  2. Grab tensile strength min 150 lb ASTM D-4632-91
  3. Mullen Burst strength min 300 psi ASTM D-3786-87
  4. Puncture strength min 90 lb ASTM D-4833-00
  5. Apparent opening size 60-70 US Sieve ASTM D-4751-99A
  6. Non-woven geotextile shall be Mirafi 160N, or approved equal.
- F. Where noted on the plans and unless otherwise noted on plans or approved by the Engineer,



impervious liners and root barriers shall be Solmax 230 (30 mil), or approved equal. Install per manufacturer's recommendations.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Owner's Representative and Engineer shall be notified at least 24 hours prior to all infiltration bed work.
- B. Subgrade preparation
  - 1. Existing subgrade under bed area shall be undisturbed and shall NOT be compacted or subject to excessive construction equipment traffic prior to installation of geotextile and aggregate.
  - 2. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake or equivalent and light tractor.
  - 3. Bring subgrade of bed to line, grade, and elevations indicated on plan. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing infiltration bed media. Infiltration bed bottom to be kept at level grade, unless otherwise noted on plans.
- C. Infiltration Bed Installation
  - 1. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his discretion before proceeding with infiltration bed installation.
  - 2. Geotextile and bed media shall be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of geotextile at no extra cost to the Owner.
  - 3. Place geotextile in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile shall overlap a minimum of sixteen inches (16"). Secure geotextile at least four feet (4') outside of bed and take steps necessary to prevent any runoff or sediment from entering the bed. This geotextile edge strip shall remain in place until all bare soils contiguous to infiltration bed have been stabilized. When the site is fully stabilized, excess geotextile along bed edges can be cut back to gravel edge.
  - 4. Where noted, install impervious liner as indicated between infiltration bed and adjacent pavement subbase.
  - 5. Install infiltration bed media to grades indicated on the drawings. If used, install modular storage system per manufacturer's recommendations. Install coarse aggregate in 8 inch maximum lifts. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install stormwater utilities as indicated in Section 02720 and pavement courses as indicated on plan.

**END OF SECTION 02725**

## **SECTION 02911 - PLANTING SOIL FOR MODULAR TREE CELLS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:

- 1. Furnishing and installation of Planting Soil within the modular tree cell system.

- B. Related Sections:

- 1. Section 02216 "Modular Tree Cells"
- 2. Section 02520 "PCC Sidewalks and Driveways"
- 3. Section 02630 "Unit Pavers"
- 4. Section 02720 "Drainage"
- 5. Section 02725 "Subsurface Infiltration Bed"
- 6. Section 02930 "Exterior Plants"

#### **1.3 DEFINITIONS**

- A. Planting Soil: Soil, of a variety of textures, defined in this section, intended to fill the frames and other planting spaces to support the growth of trees and other plants.
- B. Modular Tree Cells: Plastic structural cellular system with post, beams and decks designed to be filled with planting soil for tree rooting and/or be used for water storage and support vehicle loaded pavements.
- C. Tree: A perennial woody plant with one or several trunks and a distinct crown and intended to become large enough to shade people and or vehicles.

#### **1.4 SUBMITTALS**

- A. Prior to ordering materials, the Contractor shall provide submittals required in this section to the Engineer/Owner for review and approval.
- B. Product Data: For each type of product, submit manufacture's product literature with technical data sufficient to demonstrate that the product meets these specifications.
- C. Material Certificates: Submit material certificates for all natural and bulk material indicating that the material meets the requirements of the specification to the Engineer for approval.

D. Samples for Verification: Submit samples of each product and material where required by the specification to the Engineer for approval. Label samples to indicate product, specification number, characteristics, and locations in the Work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the contractor. Delivered materials shall closely match the samples.

1. Submit two gallon samples of all topsoil, sand, soil additive products, and planting mixes in this section. The number of samples shall be as required for each material.

- a. Samples should be labeled to include the location of the source of the material.
- b. Samples of all topsoil, sand, soil additive products, planting soil and planting mix shall be submitted at the same time as the particle size and physical analysis of that material.
- c. Planting mixes shall be labeled as to the percentage of each component in the mix.

2. Submit soil test analysis report for each sample of topsoil, planting soil and planting mix from an approved soil-testing laboratory.

- a. The soil testing laboratory shall be approved by the Engineer in advance. The testing lab shall be a member of the Soil Science Society of America's, North American Proficiency Testing Program (NAPT), and have a minimum of 5 years experience with the test protocols of the United States Golf Association - Green Section.
- b. Provide a particle size analysis including the following gradient of mineral content:

<u>USDA Designation</u>	<u>Size in mm.</u>
Gravel	+2mm
Very Coarse Sand	1-2 mm
Coarse Sand	0.5 -1 mm
Medium Sand	0.25-0.5 mm
Fine Sand	0.1-0.25 mm
Very Fine Sand	0.05-0.1 mm
Silt	0.002-0.05 mm
Clay	minus 0.002 mm

c. Provide a chemical analysis including the following:

pH and Buffer pH

Percent organic content by oven dried weight.

Nutrient levels by parts per million including nitrogen, phosphorus, potassium magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the planting mix.

Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.

Cation Exchange Capacity (CEC).

Chemical analysis shall include recommendations from the soils laboratory as to ranges of each element appropriate for the types of plants to be grown in the soil.

- d. Provide a physical analysis of each planting mix to include the following test results:

Water permeability with the sample compacted to 80% and 85% maximum proctor density utilizing proctor test (ASTM D 698-91). Test results shall indicate bulk density of oven dry sample at 80% and 85% expressed in grams per cubic centimeter.

For bioretention soil, also provide soil infiltration rate in inches per hour before and after installation using standard acceptable practices such as a double ring infiltrometer..

- e. All testing will be at the expense of the Contractor. The Engineer may request additional Planting mix test on different mix component ratios in order to attain results that more closely meet the mix requirements.
3. Submit the manufacturer's particle size analysis for all sand and gravel to the Engineer for approval. Provide the manufacturer's Fines Modulus Index for each sand source.
  4. Submit the manufacturer's particle size analysis, pH and certificate of length of composting period for all pine bark and other organic materials to the Engineer for approval.

#### 1.5 SOIL INSTALLATION MOCK UP AND COMPACTION EVALUATION

- A. Prior to the installation of planting soil within the modular tree cells, construct a mock up of the complete installation at the site. The installation of the mock up shall be in the presence of the Engineer.
- B. The modular tree cell mock up shall be as described in Specification Section 02216 Modular Tree Cells.

#### 1.6 SCHEDULING

- A. General: Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.
- B. Schedule all utility installations prior to beginning work in this section.
- C. Where possible, schedule the installation of planting soil within the modular tree cells immediately after the installation of the modular tree cell frames. Protect installed modular tree cells from damage in the event that work must occur over or adjacent to the completed modular tree cells.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Soil within the modular tree cells shall be installed by the same contractor who is installing the modular tree cells. See Specification Section 02216 Modular Tree Cells for installer qualifications.

## 1.8 PERMITS AND CODE COMPLIANCE

- A. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from all such authorities.

## 1.9 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. Protect materials from deterioration during delivery and while on the project site.
- B. Bulk Materials: Do not deliver or place backfill, soils and soil amendments in frozen, wet, or muddy conditions.
  - 1. Do not dump or store bulk materials near structures, utilities, sidewalks, pavements, and other facilities, or on existing trees, turf areas or plants.
  - 2. Provide protection including tarps, plastic and or matting between all bulk materials and any finished surfaces sufficient to protect the finish material.
- C. Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.
- D. Protect modular tree cells from damage during installation of planting soil.

## 1.10 PROJECT CONDITIONS

- A. During the installation of Planting Soil within the modular tree cells comply with all project conditions in Specification Section 02216 - Modular Tree Cells
- B. Weather Limitations: Do not proceed with work when subgrades, soils and planting soils are in a wet, muddy or frozen condition.

## 1.11 PROJECT WORK

- A. Coordinate installation with all other work that may impact the completion of the work.

## 1.12 PRECONSTRUCTION MEETING

- A. Prior to the start of the installation of Planting Soil within the modular tree cells, meet at the site with the Engineer, general contractor and the modular tree cells installer to review installation layout, procedures, means and methods.

## PART 2 - PRODUCTS

### 2.1 TOPSOIL (FOR USE AS A BASE IN A PLANTING SOIL MIX)

- A. Fertile, friable, loamy soil, containing 1.5 to 5 percent by dry weight organic matter; free from subsoil, refuse, roots, heavy or stiff clay, stones larger than 1 inch, noxious seeds, sticks, brush, litter, and other deleterious substances; suitable for the germination of seeds and the support of vegetative growth. The pH value shall be between 5.5 and 7.5. Soil shall be harvested at a single source from the O and or A horizons of the soil profile. Soil source location and extent of area suitable for harvest shall be approved by the Engineer.
- B. Soil Texture: Loam, Sandy loam, sandy clay loam, with clay content between 20 and 35% and silt content between 15 and 30%. Gravel and stone content shall be less than 10% by weight.
- C. Provide a minimum of 3 soil tests from samples obtained throughout the source stockpile that represent the range of the soil available at the source.
- D. Provide a two gallon sample from each top soil source with soil testing results. The sample shall be a mixture of the random samples taken around the source stockpile or field.

### 2.2 COMPOST

- A. Compost shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Compost feedstock shall be yard waste trimmings and/or source-separated municipal solid waste to produce a fugally dominated compost. The product must not contain any visible refuse or other physical contaminants, substances toxic to plants, or over 5% sand, silt, clay or rock material by dry weight. The product shall possess no objectionable odors. The product must meet all applicable USEPA CFR, Title 40, Part 503 Standards for Class A biosolids. The moisture level shall be such that no visible water or dust is produced when handling the material.
- B. Compost shall be dark brown in color, approximately the color of dark chocolate candy (70% chocolate). Black compost and compost the color of milk chocolate shall be rejected.
- C. Compost shall have a strong aerobic (sweet) odor. Compost lacking a strong aerobic odor or which has an anaerobic (sour) odor shall be rejected.
- D. Testing: The results of Compost analysis shall be provided by the Compost supplier. Before delivery of the Compost, the supplier must provide the following documentation:

1. Feedstock percentage in the final Compost product
2. A statement that the Compost meets federal and state health and safety regulations
3. A copy of the lab analysis, less than four months old, performed by a Seal of Testing Assurance Certified Laboratory verifying that the Compost meets the following requirements:.

### **Physical Requirements for Composted Organic Matter**

<b>Parameter</b>	<b>Range</b>	<b>Testing Method</b>
pH	5.5-7.5	TMECC 4.11A
Soluble Salt Concentration	< 4dS/m	TMECC 4.10-A
Moisture	35-55% wet weight basis	
Organic Matter	>35% dry weight basis	TMECC 5.07-A
Carbon to nitrogen ratio	15:1 -30:1	
Particle Size	99% pass through 2 inch screen or smaller; 25% pass through 3/8 inch screen or smaller	TMECC 2.02-B
Maturity Index	6 to 8	Solvita
Physical contaminants (man made inerts)	<1% dry weight basis	TMECC 3.08-A
Chemical contaminants	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels:	
Arsenic	< 41ppm	TMECC 4.06-AS
Cadmium	< 39 ppm	TMECC 4.06-CD
Copper	< 1,500 ppm	TMECC 4.05-CU
Lead	< 300 ppm	TMECC 4.06-PB
Mercury	< 17 ppm	TMECC 4.06-HG
Molybdenum	< 75 ppm	TMECC 4.05-MO
Nickel	< 420 ppm	TMECC 4.06-NI
Selenium	< 100 ppm	TMECC 4.06-SE
Zinc	< 2,800 ppm	TMECC 4.06-ZN
Biological contaminants (pathogens)	Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels:	
Fecal coliform	< 1,000 MPN per gram, dry weight basis	TMECC 7.01
Salmonella	< 3 MPN per 4 grams, dry weight basis	TMECC 7.02

Compost testing methodologies and sampling procedures shall be as provided in Test methods for the Examination of Composting and Compost (TMECC), as published by the US Composting Council.

- E. Provide a two gallon sample with manufacturers literature and material certification that the product meets the requirements.

2.3 COARSE SAND

- A. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.
  - 1. Sands shall be clean, sharp, natural sands free of limestone, shale and slate particles. Sand PH shall be lower than 7.0
  - 2. Provide the following particle size distribution:

<u>Sieve</u>	<u>Percent Passing</u>
3/8" (9.5mm)	100
No 4 (4.75mm)	95-100
No 8 (2.36mm)	80-100
No 16(1.18mm)	50-85
No30 (.60mm)	25-60
No50 (.30mm)	10-30
No100 (.15mm)	2-10

- B. Provide a two gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.4 PLANTING SOIL MIX FOR MODULAR TREE CELLS

- A. Planting mix of compost and coarse sand mixed to the following proportion.

<u>Material</u>	<u>% by volume</u>
Compost	20%
Coarse Sand	80%

Adjust the ratio of the components to achieve water permeability; minimum 4 inches per hour, when compacted to 80-85% of maximum dry density. Submit multiple mix ratios for permeability testing to establish the correct mix ratio for the bioretention soil mix.

- B. Planting mix shall be thoroughly mixed prior to installation.
- C. Final mix shall have a pH of between 6.0 and 7.5.
- D. Provide one (two gallon) sample of each mix ratio with the required soil test results.

PART 3 - EXECUTION

- A. Install planting soil in modular tree cells and mulch as described in Section 02216 - Modular Tree Cells.

**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, vines, ground covers, ornamental grasses, bulbs, corms, tubers, 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.
  - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- 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. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- F. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees 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.
- 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, Vines, and Ornamental Grasses: 12 months.
  - b. Ground Covers, Biennials, Perennials, 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 and Shrubs: 12 months from date of planting completion
  2. Maintenance Period for Ground Cover 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 [1] [4] percent nitrogen and [10] [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 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.

## 2.5 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.

- 2.6 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 as directed by Landscape Architect 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.
- A. 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.
- B. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

- C. 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, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by 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. Do not place mulch within 6 inches (150 mm)] of trunks or stems.

### 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 02216 – Modular Tree Cells
4. Section 02911 – Planting Soil for Modular Tree Cells
5. Section 02930 – Exterior Plants
6. 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 an 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. *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. Submit complete test results and samples of the S3 and organic soil amendment (compost) materials for approval as described within Part 1 following criteria of Part 2 of this section.
2. 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.
3. 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 test results.

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 CO<sub>2</sub> evolution sometimes called respirometry.
  - b. Reaction in 1:1 water
  - c. Carbon/Nitrogen ratio
  - d. Foreign Material on a dry weight basis
  - e. Organic Matter 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 such as ASTM D422, 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 (CEC) 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 materials.
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 require 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 Engineer for selection and approval. Do not order materials until the Owner's approval has been obtained. Schedule at least 4 weeks for soil ingredient search and initial submittal approval. Delivered materials shall closely match the approved samples.

1. *Organic amendment:* submit duplicate samples of 1 quart.
2. *Planting Soils:* submit 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 ft<sup>2</sup> 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 200 lbs/in<sup>2</sup>. There shall not be any compacted dense layers within the soil profile greater than 50 lbs/in<sup>2</sup> 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 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. *Mulch*: Mulch shall consist of aged, shredded hardwood bark and wood fiber free of foreign materials, ranging in size from ½” to 3”.

#### C. *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.

**D. Planting Soils:**

1. *Soil layer (S3):* Planting Soil Drainage Layer consisting of a 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/stormwater trench shall have, uniformly increasing with depth, a penetration resistance of < 200 lbs/in<sup>2</sup> after installation. No dense layers (+ 50 lbs/in<sup>2</sup> 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
<b>Chemical</b>		
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 6- to 8-inch layer consisting of material with a USDA Texture of sand to loamy sand amended with organic matter (must be tested to meet specified requirements 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/in<sup>2</sup> after installation. No dense layers (+ 25 lbs/in<sup>2</sup> 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
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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
<b>Chemical</b>		
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

E. *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 Test, <u>or</u>	VI – V
	Solvita Maturity Index, <u>or</u>	6 – 8
	CO <sub>2</sub> 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.

F. *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

G. *Landscape Underdrainage Pipe Filtration Aggregate:*

1. The perforated underdrainage pipes shall require a minimum 4 inch gravel filtration encasement to protect the pipe from siltation from the overlying soil material.
2. In order to best match the sand particle size and allow for laminar inflow of water, clean, washed NYSDOT #1 stone, free of dust, fines, or soil particles, is required.
3. No geotextile fabric is to be used separating the gravel layer from the overlying sand layer. Non-woven geotextile shall be used to line the drainage trench (bottom and sides) and used to temporarily cover the crushed stone to prevent siltation from other construction until the planting soil is in place.

H. *Landscape Underdrainage Perforated Pipe:*

1. *Landscape Underdrainage Piping:* Landscape underdrainage piping will be placed in a 12”W x 12”D trench pitched >0.5% to the outlet. Piping will be placed as noted on the Plans.

STANDARD	MEETS ASTM F810 OR F405
SIZE	4” or as shown.
PERFORATION	¼” inflow holes @ 6” on center, located at the 4- and 8-o’clock position of the installed pipe

I. *Landscape Drainage and Structural Soil Filter Fabric:*

1. A drainage-type non-woven geotextile fabric shall be used as a separation layer to prevent the surrounding in-situ subgrade soil from migrating into the underdrainage system. The geotextile is used to line the entire trench excavation prior to placement of any crushed stone and underdrainage piping. The permeability of the drainage fabric shall be a minimum of 110 gal/min/sq.ft.
2. Drainage geotextiles fabric shall meet the following Minimum Average Roll Value (MARV) specifications:

PROPERTY	TEST METHOD	REQUIREMENT	PROPERTY	TEST METHOD	REQUIREMENT
Grab Tensile Strength	ASTM D-4632	150 lb. min.	Puncture Strength	ASTM D-4833	90 lb. min.
Grab Tensile Elongation	ASTM D-4632	50% max.	UV Resistance	ASTM D-4335	70% at 500 hrs min.
Trapezoidal Tear Strength	ASTM D-4533	35 lb. min.	Apparent opening	ASTM-D-4751	40-80 US Sieve
Mullen Burst Strength	ASTM D-3786	300 psi. min.	Permeability	ASTM D-4491	110 gal/min/ft.2 min.

## 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 plantings where tree 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-2 – Bio-Retention Basins/Tree Pits:* 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 tree 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. The piping, pea stone and fabric is also specified within 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.
- B. Scarification of the Subgrade: Scarification must loosen the surface of the subgrade following final rough grade to a depth of 4 to 6 inches prior to the designed soil placement.

### 3.3 UNDERDRAINAGE PIPING INSTALLATION

- A. Landscaping Underdrainage:
  - 1. Underdrainage shall be installed within a minimum 12” x 12” trench lined with standard filtration fabric. Locations of the underdrainage shall be placed as per the drawings.
    - a. For areas of planting soils that will use foundation drains as the landscape underdrainage, follow the Drawing Details.
  - 2. The perforated pipe with perforations at 4 and 8 o’clock (down) with a minimum gradient of 0.5 percent is applied on a bed of 4 inches of approved washed crushed pea stone.
  - 3. Cleanouts shall be placed at the upslope portion of the pipe to allow future flushing of the underdrainage system. If elbows are installed they shall be two 45 degree fittings to equal the 90 degree turn. Then gravel shall encase the pipe at least for 4 inches.
  - 4. Excess filter fabric shall be placed over the underdrainage construction prior to S3 placement to protect the gravel from siltation from other construction activities. The filter fabric shall be removed just prior to S3 placement

### 3.4 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.

### 3.5 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 issues 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. 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.
- e. Trees with rootballs less than 36 inches tall 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.
- f. Care shall be taken to maintain the separation between the designed soil layers. Do not mix the S1 or S3 with adjacent layers.
- g. 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.
- h. Planting soils shall never be moved or worked when wet or frozen.
- i. Penetration resistance shall not exceed 200 lbs/in<sup>2</sup> within the S3 and the resistance for the S1 layer shall be less than 120 lbs/in<sup>2</sup> except where otherwise noted. The planting soil shall be uniformly increasing in density with depth. There shall not be any compacted layers within the soil profile.

- j. 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/Tree Pit 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 compacted 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 or as shown 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.



### 3.6 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 / Stormwater Trench 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 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.

### 3.7 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

## SECTION 02950 – SITE FURNISHINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:

1. Benches

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.
- C. Setting Drawings: Provide setting drawings, templates, and instructions for installation of anchorage devices built into other work.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of site furnishings through one source from a single manufacturer.

### PART 2 - PRODUCTS

#### 2.1 SITE FURNISHINGS

- A. Benches

1. Benches: Scarborough Bench, Backed Model as manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website [www.landscapeforms.com](http://www.landscapeforms.com). E-mail: [specify@landscapeforms.com](mailto:specify@landscapeforms.com)
- a. Quantity: 4
- b. Length: 72 inches
- c. Center Arm: None
- d. Seat Pattern: Horizontal Strap: For exterior or interior applications, constructed of steel straps 1-1/2" x 0.188".
- e. Panel Supports: Strap Supports: End frames are 1" x 1" solid steel, joined by 1-1/2" diameter, 0.120" wall thickness tubular steel. Seat panels are perimeter welded to the end frames

- f. Finish: Black Panguard II® powdercoat
  - g. Mounting type: Surface mounted per manufacturers recommendations
  - h. Provide anchoring hardware, which shall include a 3/8-16 thread minimum size non-corrosive anchor and a minimum 2-1/2" embedment in concrete slab. If using expansion wedge anchors, install anchor leaving enough threads to go through mounting plate, washer and hex nut. Provide tamper proof nuts.
2. Benches: Scarborough Bench, Backless Model as manufactured by Landscape Forms, Inc., 431 Lawndale Avenue, Kalamazoo, Michigan 49048. Toll Free (800) 521-2546. Phone (269) 381-0396. Fax (269) 381-3455. Website [www.landscapeforms.com](http://www.landscapeforms.com). E-mail: [specify@landscapeforms.com](mailto:specify@landscapeforms.com)
- a. Quantity: 4
  - b. Length: 72 inches
  - c. Center Arm: None
  - d. Seat Pattern: Horizontal Strap: For exterior or interior applications, constructed of steel straps 1-1/2" x 0.188".
  - e. Panel Supports: Strap Supports: End frames are 1" x 1" solid steel, joined by 1-1/2" diameter, 0.120" wall thickness tubular steel. Seat panels are perimeter welded to the end frames
  - f. Finish: Black Panguard II® powdercoat
  - g. Mounting type: Surface mounted per manufacturers recommendations
  - h. Provide anchoring hardware, which shall include a 3/8-16 thread minimum size non-corrosive anchor and a minimum 2-1/2" embedment in concrete slab. If using expansion wedge anchors, install anchor leaving enough threads to go through mounting plate, washer and hex nut. Provide tamper proof nuts.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

- C. Install site furnishings level, plumb, true, and positioned at locations indicated on Drawings and according to manufacturer's instructions. Install anchor bolts when specified.

### 3.7 CLEANING

- A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.
- B. Remove temporary protective coverings
- C. Do not use harsh cleaning materials or methods that would damage finish

### 3.8 PROTECTION

- A. Protect installed furnishing from damage during construction

**END OF SECTION**