PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to owner for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at project site, 300 W. Shunk Street, Philadelphia, PA 19148.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of site improvements.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.
   2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

   1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

C. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least **<Insert number>** hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.

7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove: Existing site features marked for removal on the plans.

B. Existing to Remain: Existing site features to remain as noted on the plans.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 321313 "Concrete Paving" for concrete walks and curbs.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

1. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction and isolation joints, shoring and reshoring procedures, anchor rod and anchorage device installation tolerances,

steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

D. Surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

C. Wet-Weather Placement: Comply with ACI 301 and as follows:

1. Do not place concrete within 8 hours of forecasted rain.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

B. ADA Requirements: Concrete sidewalks, slabs and curb ramps to comply with ADA Standards for Accessible Design as indicated on the Drawings. Work that does not comply with ADA Standards is non-conforming. Non-conforming work must be corrected.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.3 STEEL REINFORCEMENT

A. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M, epoxy coated, Grade 60 deformed bars with less than 2 percent damaged coating in each 12-inch bar length.

B. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

2.4 REINFORCEMENT ACCESSORIES

A. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.

B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I.
2. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those

permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M and potable.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Slag Cement: 50 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.9 CONCRETE MIXTURES

A. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 3 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete

surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Chamfer exterior corners and edges of permanently exposed concrete.

G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Sealants: See Section 321373 “Concrete Paving Joint Sealants” for concrete joint sealants.

C. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of slabs.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into

concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

E. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

F. Doweled Joints: Install smooth dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint. Rebar or other ribbed material that may bond to concrete are not to be used.

3.7 CONCRETE PLACEMENT

A. Comply with ACI 301 requirements for concrete placement. Do not drop concrete more than 2 feet during placement.

B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, ACI 305.1 for hot-weather protection, and ACI 301 for wet-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3.11 CONCRETE SURFACE REPAIRS

A. Concrete repairs to comply with ACI 301.

B. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

C. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

5. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
   5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   6. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
      b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive

strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 11 48 00 MULTI-SPORT BALLSTOPPER SYSTEMS WITH INTEGRATED FENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all equipment and materials, and do all work necessary to furnish and install the Multi-Sport BallStopper System, as indicated on the drawings and as specified herein.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this section. Other specification sections that directly relate to work of this Section include, but are not limited to:

1. Section 033000 - Cast-in-Place Concrete; Concrete foundations and bases for goals.
2. Section 312000 – Earth Moving
3. Section 321813 – Synthetic Turf

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. U.S. Tennis Court and Track Builders Association
2. National Federation of State High School Associations (NFSHSA)
3. National Collegiate Athletic Association (NCAA)
4. International Amateur Athletic Foundation (I.A.A.F.)
5. Manufacturers Data and Recommended Installation Requirements.

1.4 SUBMITTALS

A. Manufacturers Product Data

1. Provide manufacturer's product literature, technical specifications and other data prior to actual field installation work for Architect or Owner's Representative review.

B. Shop Drawings

1. Provide drawings of manufacturers recommended installation and foundation requirements prior to actual field installation work for Architect or Owner's Representative review.

1.5 QUALITY ASSURANCE

A. Manufacturers warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Materials delivered to the site shall be examined for concealed damage or defects in shipping. Any defects shall be noted and reported to the Owner's Representative.

B. Replacements, if necessary, shall be immediately re-ordered, so as to minimize any conflict with the construction schedule.

C. Sound materials shall be stored above the ground under protective cover or indoors so as to provide proper protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers and product selections named are provided to establish the minimum standard.

1. Multi-Sport BallStopper System - As manufactured by AAE (Aluminum Athletic Equipment Co.); 1000 Enterprise Drive, Royersford, PA 19468; Toll Free (800) 523-5471.

2.2 MULTI-SPORT EQUIPMENT

A. Multi-Sport BallStopper Systems Integrated with Fence - Shall be as manufactured by AAE:

1. Model # MBS-12/IF (12' high system, straight post):
Posts: Straight Post 4"O.D. x .125" wall x 15'-0"lg., 12'- out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 4.35" O.D. x .100" wall x 30"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 28". Typical spacing between posts maximum 20'.
Net: Specify fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6" offset border overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable.
Hardware: All stainless steel, galvanized hardware, pulley system for raising/lowering net, UV-treated 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
Recommended Footing Specification: 30" diameter x 36" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

2. Model # MBS-15/IF (15' high system, straight post):
Posts: Straight Post 4"O.D. x .125" wall x 18'-0"lg., 15'- out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 4.35" O.D. x .100" wall x 30"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 28". Typical spacing between posts maximum 20'.
Net: Specify fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6" offset border overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable.
Hardware: All stainless steel, galvanized hardware, pulley system for raising/lowering net, UV-treated 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
Recommended Footing Specification: 30" diameter x 36" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

3. Model # MBS-20/IF (20' high system, straight post):
Posts: Straight Post 4"O.D. x .226" wall x 24'-0"lg., 20' out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 4.35" O.D. x .100" wall x 56"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 40". Typical spacing between posts maximum 20'.
Net: Specify fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6" offset border

overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable.
Hardware: All stainless steel, galvanized hardware, pulley system for raising/lowering net, UV-treated 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
Recommended Footing Specification: 30" diameter x 56" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

4. Model # MBS-25/IF (25' high system, straight post):
Posts: Straight Post 6.625"O.D. x .280" wall x 29'-0"lg., 25' out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 7" O.D. x .125" wall x 57"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 36". Typical spacing between posts maximum 20'.
Net: 25' high, #AAE400, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides, pre-attached sewn in 3/16"dia. galvanized clear coated cable.
Hardware: All stainless steel, galvanized and brass hardware, pulley system for raising/lowering net, 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
Recommended Footing Specification: 30" diameter x 57" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

5. Model # MBS-30/IF (30' high system, straight post):
Posts: Straight Post 6.625"O.D. x .280" wall x 35'-0"lg., 30' out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 7" O.D. x .125" wall x 72"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 54". Typical spacing between posts maximum 20'.
Net: Specify fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6" offset border overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable
Hardware: All stainless steel, galvanized hardware, pulley system for raising/lowering net, UV-treated 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
Recommended Footing Specification: 30" diameter x 72" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

6. Model # MBS-35/IF (35' high system, straight post):
Posts: Straight Post 6.625"O.D. x .280" wall x 40'-0"lg., 35' out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 7" O.D. x .125" wall x 78"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 60". Typical spacing between posts maximum 20'.

Net: Specify fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6” offset border overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable.
Hardware: All stainless steel, galvanized and brass hardware, pulley system for raising/lowering net, 3/8" braided rope with pre-attached hardware, a cleat for rope tie-off, and a clamp with snap at bottom of post to secure net.
Recommended Footing Specification: 36" diameter x 78" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

Model # MBS-40/IF (40' high system, straight post):
Posts: Straight Post 8"O.D. x .188" wall x 46'-0"lg., 40'-0" out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 8.625" O.D. x .150" wall x 78"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 60". Typical spacing between posts maximum 20’.
Net: Specify fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6” offset border overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable.
Hardware: All stainless steel, galvanized hardware, pulley system for raising/lowering net, UV-treated 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
Recommended Footing Specification: 36" diameter x 78" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where equipment and systems are to be installed and notify the contractor of conditions detrimental to the proper and timely installation and completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable and to the satisfaction of the Architect/Engineer or Owner's Representative.

3.2 INSTALLATION

A. All athletic equipment shall be installed as indicated on approved submittals as recommended and in strict accordance with manufacturer's written directions and as indicated on the drawings and specified herein.

B. All concrete footings for athletic equipment shall be installed as indicated on the drawings and in accordance with Section 03300, Cast-in-Place Concrete.

C. All sleeves required for athletic equipment installation shall be set plumb and true to line and grade in concrete as indicated on the drawings and per manufacturer's recommendation.

D. All athletic equipment shall be installed in strict accordance with the latest rules, regulations and specifications governing that sport or event for which it is being installed.

3.3 TESTING, ADJUSTMENT AND OPERATION

A. All athletic equipment requiring testing, adjustments and operation shall be tested for proper operation and adjusted to conform to specified standards.

B. Provide certifications as required, indicating that equipment has been tested and adjusted to conform to specified standards.

C. Provide operating and maintenance instructions and manuals to Owner - designated personnel for the proper operation and care of equipment after equipment has been tested and adjusted to conform to specified standards.

3.4 CLEANING

A. Upon completion of work in any given area, remove all trash and debris from the work area and leave in clean condition.

- END OF SECTION -

SECTION 12 93 00 SITE FURNISHINGS

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. Trash receptacle
   2. Combination football/soccer goalpost
   3. Football goalpost pads
   4. Ball Control Netting

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's standard product literature for each type of product, including shop drawings, installation instructions, and maintenance instructions.

B. Samples: For each exposed product and for each color and texture specified.

C. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 TRASH RECEPTACLE

A. Products: Subject to compliance with requirements, provide the following or approved equal.

   1. Trash Receptacle

a. Style: Model #158-32SH
b. Materials: Steel Receptacle and Shield, Plastic Liner
c. Finish: Powdercoat Textured Charcoal
d. Size: 32 Gallon.
e. Installation: Surface Mount expansion anchor bolts, size ½"x3-¾", as provided by manufacturer
f. Manufacturer: Dumor Inc. 138 Industrial Circle, Mifflintown, PA 17059 Dumor.com

2.2 COMBINATION FOOTBALL/SOCCER GOALPOST AND PADS

A. Combination football/soccer goalposts shall be minimally 30' uprights, white finish, on minimum four (4) pneumatic wheels, including wind flags atop each upright, meeting NFHS requirements for soccer and footall, as manufactured by one of the following:

1. Aluminum Athletic Equipment
1000 Enterprise Drive
Royersford, PA 19468
aaesports.com

2. KwikGoal Ltd.
140 Pacific Dr.
Quakertown, PA 18951
kwikgoal.com

B. Football goalpost pads shall be 6' high, 6" inside diameter, Royal Blue color as provided by one of the following:

1. Aluminum Athletic Equipment
1000 Enterprise Drive
Royersford, PA 19468
aaesports.com

2. Sports Edge
P.O. Box 837
259 Murdock Road
Troutman, NC 28166

Quantity: Four (4)

2.3 BALL CONTROL NETTING SYSTEM

A. 40' Model # **MBS-40** (40' high system, straight post):

B. Posts: Straight Post 8"O.D. x .188" wall x 45'-8"lg., 40'-8" out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 8.625" O.D. x .148" wall x 78"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 60". Typical spacing between posts 20' maximum. Provide heavy duty sleeve caps.

C. Net: 40' high, #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360# tensile strength, ¼" MFP rope border all 4 sides, pre-attached sewn in 3/16"dia. galvanized clear coated cable.

D. Hardware: All stainless steel, galvanized and brass hardware, pulley system for raising/lowering net, 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, and a clamp with snap at bottom of post to secure net.

E. Recommended Footing Specification: 36" diameter x 84" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

F. As manufactured by:

1. Aluminum Athletic Equipment
   1000 Enterprise Drive
   Royersford, PA 19468
   aaesports.com

2.4 BALL CONTROL NETTING SYSTEM INTEGRATED WITH FENCES

A. Model # **MBS-20/IF** (20' high system, straight post):

B. Posts: Straight Post 4"O.D. x .226" wall x 24'-0"lg., 20' out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 4.35" O.D. x .100" wall x 56"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 40". Typical spacing between posts maximum 20’. Provide heavy duty sleeve caps.

C. Net: 96” fence height (net attaches top rail of fence), #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotless net, 360 lbs. tensile strength, ¼" MFP rope border all 4 sides and 6” offset border overlap, pre-attached sewn in 3/16"dia. galvanized clear coated top cable.

D. Hardware: All stainless steel, galvanized hardware, pulley system for raising/lowering net, UV-treated 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.

E. Recommended Footing Specification: 30" diameter x 56" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

F. As manufactured by:

1. Aluminum Athletic Equipment
   1000 Enterprise Drive
   Royersford, PA 19468
   aaesports.com

G. BALL CONTROL NETTING

2.5 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 of the Work.

B. Verify that substrates are stable and capable of supporting the weight of items covered under this section.

C. Verify the substrates have been adequately prepared to securely anchor those items that will be surface mounted.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

2.6 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 securely anchored at locations indicated on Drawings.

D. It is the responsibility of the installer to ensure that all base materials into which the furnishings will be installed can support the rack and will not be damaged by any required installation procedures.

END OF SECTION 12 93 00

SECTION 31 10 00 SITE CLEARING

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. This Section includes the following:

1. Clearing and grubbing.
2. Removing above- and below-grade site improvements.
3. Disconnecting, capping or sealing, and abandoning site utilities in place.
4. Temporary erosion and sedimentation control measures.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.6 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 312000 EARTH MOVING

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.

B. City of Philadelphia and PennDOT standard specifications. The most stringent requirements shall be considered the base requirements.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for walks, pavements, turf and grasses, and plants.
3. Subbase course for concrete walks and pavements.
4. Subbase course and base course for asphalt paving.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.
7. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

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

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

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

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

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom.
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

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

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

- Personnel and equipment needed to make progress and avoid delays.
- Coordination of Work with utility locator service.
- Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
- Extent of trenching by hand or with air spade.
- Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).
2. Warning Tape: 12 inches (300 mm) long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698 or ASTM D 1557.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer.

C. Utility Locator Service: Notify PA One Call for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 311000 “Site Clearing" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, SM, GC, SC, ML and PT according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups CL, OL, CH, MH, and OH according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with

100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33/C 33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

- Grab Tensile Strength: 120 lbf; ASTM D 4632.
- Mullen Burst Strength: 225 PSI; ASTM D 3786.
- Tear Strength: 56 lbf; ASTM D 4533.

3. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

- Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
- Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
- Tear Strength: 90 lbf (400 N); ASTM D 4533.
- Puncture Strength: 90 lbf (400 N); ASTM D 4833.

3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150/C 150M, Type I, Type II or Type III.
2. Fly Ash: ASTM C 618, Class C or F.

3. Normal-Weight Aggregate: ASTM C 33/C 33M, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869/C 869M.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260/C 260M.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 36 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 140 psi when tested according to ASTM C 495/C 495M.

C. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C 495/C 495M.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

- 24 inches outside of concrete forms other than at footings.
- 12 inches outside of concrete forms at footings.
- 6 inches outside of minimum required dimensions of concrete cast against grade.
- Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- 6 inches beneath bottom of concrete slabs-on-grade.
- 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    - Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

    - 24 inches outside of concrete forms other than at footings.
    - 12 inches outside of concrete forms at footings.
    - 6 inches outside of minimum required dimensions of concrete cast against grade.
    - Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - 6 inches beneath bottom of concrete slabs-on-grade.
    - 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit as indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.

4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

    - Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 95 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

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

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

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

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 31 23 19 DEWATERING

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 construction dewatering.

B. Related Sections:

1. Division 01 Section Construction Progress Documentation for recording preexisting conditions and dewatering system progress.

2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

4. Division 33 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.

3. Prevent surface water from entering excavations by grading, dikes, or other means.

4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

5. Remove dewatering system when no longer required for construction.

6. Place filter bags on stable or well vegetated areas which are flatter that 5% and which will not erode when subjected to bag discharge. If stable or well vegetated area is unavailable discharge runoff to PWD combined sewer system. An industrial waste permit from PWD is required prior to pumping to PWD sewer.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

C. Other Informational Submittals:

1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to dewatering including, but not limited to, the following:

a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
b. Geotechnical report.
c. Proposed site clearing and excavations.
d. Existing utilities and subsurface conditions.
e. Coordination for interruption, shutoff, capping, and continuation of utility services.
f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
g. Testing and monitoring of dewatering system.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Architect's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.

2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

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

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

2. A PWD Industrial Waste Permit is required for any pumping to city-owned infrastructure. Obtain the necessary permit approvals prior to pumping to City owned infrastructure.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.

2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

SECTION 31 50 00 EXCAVATION AND SUPPORT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes excavation support and protection systems.

B. Related Sections include the following:

1. Division 31 Section "Earthwork" for excavating and backfilling.

1.3 PERFORMANCE REQUIREMENTS

A. Design, provide, monitor, and maintain an anchored and braced excavation support and protection system capable of resisting soil and hydrostatic pressure and supporting sidewalls of excavations.

1. Work includes removing excavation support and protection systems when no longer needed.

2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Install excavation support and protection systems without damaging existing buildings, pavements, utilities and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems. System design and calculations must be acceptable to authorities having jurisdiction.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

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

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.

1. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project Site Information: A geotechnical report has been prepared for this Project and is available for information only. The report is part of the Contract Documents. The opinions expressed in this report are those of the engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Make additional test borings and conduct other exploratory operations as necessary.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

1.7 PRODUCTS

A. None

1.8 MATERIALS

A. Materials need not be new but must be in serviceable condition.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piling: ASTM A 328 or ASTM A 572.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.

1.9 EXECUTION

A. Not Applicable

1.10 PREPARATION

A. Protect structures, utilities, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards that could develop during excavation support and protection system operations.

1. Shore, support and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Locate excavation support and protection systems clear of permanent construction and to permit forming and finishing of concrete surfaces.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage or other evidence of movement to ensure excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities, to the satisfaction of the Owner caused by installing excavation support and protection systems.

1.11 SOLDIER BEAMS AND LAGGING

A. Install steel soldier piles before starting excavation. Space soldier piles at intervals indicated. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil and compact.

C. Install wales horizontally at centers indicated and secure to soldier piles.

1.12 SHEET PILING

A. Install one-piece sheet piling and tightly interlock to form a continuous barrier. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

1.13 TIEBACKS

A. Tiebacks: Drill for, install, tension and grout tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1.14 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction and other permanent work. If necessary to move a brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by architect.

2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

1.15 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and damaging structures, pavements, facilities and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.

2. Repair or replace, as approved by architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of installing a certified plant-mixed HMA Binder or Wearing course on a prepared surface within reasonably close conformity to the lines, grades and limits shown on the construction documents. The base course shall be constructed to the minimum compacted depth and density and to the distances below the finished grade, as indicated in the construction documents.

1.2 DESIGN STANDARDS

A. Unless otherwise indicated, the following design standards shall be used:

1. Mix Design – 19mm. - Binder
   9.5mm - Wearing
2. Equivalent Single Axle Load – 3.0 to 10.0 million.
3. Performance Grade – PG 64-22.
4. Mat Thickness – 50mm Binder Course
   40mm Wearing Course
5. Skid Resistance Level (SRL) – Level H

B. All standards shall be in accordance with PennDOT Publication 408, latest edition, Sections 309 and 409.

1.3 MIXTURE ACCEPTANCE

A. For Township Roads, Certification Acceptance level will be used. Criteria for acceptance shall be as specified in PennDOT Publication 408, Section 409.2(f).

B. Provide PennDOT Form CS-4171 from a plant approved in Bulletin 15. Attach all QC test results to the form. Certify mixture as specified in Section 106.03 and the requirements of Section 409.

C. Provide all forms and supporting certifications to the Engineer a minimum of 10-days prior to the commencement of work.

D. For State Highways, mixture acceptance may be by other methods, as specified in PennDOT Publication 408, Section 409. It is incumbent upon the contractor to contact the PennDOT representative to determine which criteria for acceptance will be used for the specific project.

1.4 MATERIAL

B. All material shall be in accordance with Section 409.2 of PennDOT Publication 408, latest edition.

1.5 EQUIPMENT

A. Hauling Equipment.

1. Haul the mixtures in tightly sealed vehicles that do not contain petroleum oils, solvents, or other materials that adversely affect the mix.
2. Provide covers of sufficient size and quality to protect the entire load under all conditions.
3. Maintain the proper and uniform temperature specified in Section 409.3(h)1 of PennDOT Publication 408, latest edition.
4. Provide insulation on all sides of the truck body, a double-walled body, or a heated body when the air temperature is below 50°F.

B. Bituminous Pavers

1. Use self-contained, power-propelled units with activated screeds or activated strike-off assemblies and with automatic screed controls capable of producing a finished surface of the specified evenness and texture.
2. Provide heated units capable of spreading and finishing the mixture to the widths and depths indicated.
3. Provide units capable of being operated at forward speeds consistent with the satisfactory laying of the mixture and equipped with receiving hoppers having sufficient capacity for uniform spreading and equipped with distribution systems that place the mixture uniformly in front of the screeds.
4. Do not use any equipment that tears, shoves, or gouges the mixture or that causes tracks, indented areas, flushing segregation or other permanent blemishes. Do not use blade graders or other earthmoving equipment.

C. Rollers

1. Use steel-wheel, pneumatic-tire or vibratory rollers as specified in Section 108.05(c)3 of PennDOT Publication 408, latest edition. Operate rollers according to manufacturer's recommendations.

1.6 CONSTRUCTION METHODS

A. Weather Limitations

1. Do not place base course when the air or prepared surface temperature is 40°F or lower.
2. If work is halted because of weather conditions, the Contractor may be permitted to place limited quantities of material that is en route to the project provided the placement is approved by the Project Representative on site.
3. Should the conditions not permit the material to be placed, the Contractor shall have no recourse for payment of any unused material.

B. Preparation of Existing Surface.

1. Remove and dispose of all loose and foreign material including, dirt, dust, mud, excess joint and crack sealer and all other foreign material. Employ a power or portable truck broom for large areas.
2. Should excessive amounts of dirt and/or dust be embedded within the base course, the Engineer may order the surface to be blown off with compressed air to remove this material.
3. All surfaces to receive either binder or wearing course must be dry.
4. Before overlaying any surfaces, apply specified tack coat at a rate in accordance with Section 460 or as directed by the Engineer.
5. Paint all vertical surfaces of curbs, structures, gutter and pavements that will be in contact with bituminous mixtures with a uniform coating of bituminous material, Class E6 or E8.

C. Spreading and Finishing.

1. Unless otherwise directed, deliver, place and compact pawns, mixtures during daylight hours.
2. Ensure that mixtures are delivered and placed at the following laying temperatures. Ensure mixture does not contain lumps of cold material

	TEMPERATURE OF MIXTURE	
CLASS OF MATERIAL	MIN (°F)	MAX (°F)
PG 64-22	265	320

For other classes of material, refer to PennDOT Publication 408, Section 409.2 for temperature ranges.

3. Spread and strike off the mixture for the entire lane width or as much lane width as practical. Adjust screed assemblies to provide the required cross section and depth. After spreading, do not add any mixture to the mat that is segregated, below the minimum temperature, contains either a deficiency or excess of asphalt, or is otherwise unsuitable.
4. In areas where mechanical spreaders cannot be used, place and screed the mixture with suitable hand tools. Do not use rakes.
5. Install the binder or wearing course to within 6 mm (1/4-inch) of final elevations. Remove and replace any irregularities more than 6 mm (1/4-inch).

D. Joints

1. Longitudinal.

a. Plan joint locations to ensure that the joint in the top layer is at the approximate pavement centerline for two-lane roadways and within 300 mm (12-inches) of the lane lines for roadways with more than two lanes. Offset joints in a layer from the joint in the layer immediately below by approximately 150 mm (6-inches).

b. If traffic or other causes distort the lane edge, restore it to its original shape using either a vertical or notched wedged joint per Section 409.3 of PennDOT Publication 408, latest edition.

2. Transverse.

a. Construct joints perpendicular to the pavement centerline.
b. Provide a true vertical surface and cross section throughout the entire joint. All joints within the wearing course shall be saw joints.
c. Paint the joint face with a thin coating of bituminous material before placing fresh mixture against the joint face.

E. Compaction.

1. Compact the mixture to achieve the density acceptance requirements and to eliminate all roller marks.
2. Compact the mixture while it is in the proper condition. Adjust roller speed, amplitude, frequency pattern and roller size to eliminate displacement, shoving, cracking and aggregate breakage. Satisfactorily correct all displacement.
3. Maintain wheels of the steel-wheel rollers moist and clean to prevent the mixture from adhering to the wheels.
4. For areas inaccessible to rollers, compact with mechanical vibrating hand tampers.

F. Mat Density Acceptance.

1. Density acceptance level will be either by Non-Movement or Optimum – Rolling Pattern as outlined in PennDOT Publication 408, Section 409.3.
2. Density limits shall comply with Table E of Section 409.3, Publication 408, latest edition.

G. Field Technician.

1. Provide a certified HMA field technician in accordance with the qualifications outlined in Publication 351 to control placement of the bituminous mixtures. The certified HMA field technician must be onsite and carry a valid certification card during placement of all HMA mixtures.

H. Protection of Courses.

1. Do not allow vehicular traffic or loading on newly compacted courses until adequate stability and adhesion is obtained and the material has cooled to 140°F or less.

I. Surface Tolerance.

1. Surface tolerance shall be as defined by Section 409.3(L). The pavement will be considered defective if irregularities are more than 3/16-inch over a 10-foot length.

J. Defective Work.

1. Remove and replace all work determined to be defective by the Engineer. Defective work will be as defined in PennDOT Publication 408, latest edition, Sections 105, 309 and 409.
2. Defective work will not be measured for payment until it is satisfactorily corrected.

END OF SECTION 321216

SECTION 133423 FABRICATED CONTROL BOOTHS

Part 1 – GENERAL

1.01 SUMMARY

Contractor to furnish transportable precast concrete building components. Building to be delivered and placed on Owner's prepared foundation in accordance with Manufacturer's recommendations. Precast building to be EASI-SET™ Model 1214 as manufactured by M&W PRECAST LLC – Ottsville, PA (610-847-1423). Building is to be provided by Manufacturer with all necessary openings as specified by Contractor in conformance with Manufacturer's structural requirements.

1.02 REFERENCES

A. American Society for Testing and Materials
   1. ASTM A185; Standard Specification for Steel Welded Wire Reinforcement, Plain for Concrete
   2. ASTM A615; Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

B. American National Standards Institute (ANSI):
   1. ANSI A115.1; Preparation for Mortise Locks for 1-3/4" Doors
   2. ANSI A156.1; Butts and Hinges
   3. ANSIA156.13; Mortise Locks and Latches Series 1000

C. BOCA, Building Officials& Code Administrators International, Inc.

D. ACI-318-02, "Building Code Requirements for Reinforced Concrete".

E. Concrete Reinforcing Institute, "Manual of Standard Practice".

F. ANSI/ASCE-7-2 "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures".

G. International Building Code (IBC) - 2015

H. UL-752 test method level 4 for bullet resistance certified by an independent structural engineer.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Provide a building designed in accordance with ACI-318 and local prevailing building codes for reinforced concrete and manufactured under Prestressed Concrete Institute (PCI) standards and Quality Control Manual MNL-116.

B. Dimensions:
   1. Exterior: 14'-0" x 20'-0" x 11'-3" high
   2. Interior: 13'-8" x 19'-4" x 8'-0" minimum ceiling height

C. Design Loads:

1. Seismic Load Performance Category 'C', Exposure Group III
2. Standard Live Roof Load – 60 psf
3. Standard Floor Load – 250 psf
4. Standard Wind Loading – 130 mph

D. Gabled Concrete Roof: Roof panels shall slope from approximately 33" above center of long-sided direction toward left and right long-sided walls. Exterior surface to be cast with smooth steel trowel finish. The roof shall extend a minimum of 2-½" beyond the vertical wall panel on each side and have a turndown design which extends ½" below the top edge of the wall panels to prevent water migration into the building along the top of wall panels. Roof shall also have a smooth edge.

E. Roof, floor and walls panels must each be produced as single component monolithic panels. No roof, floor or vertical wall joints will be allowed, except at corners. Wall panels shall set on top of floor panel.

F. Floor panel must have ½" step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

1.04 QUALITY ASSURANCE

A. Manufacturer must be producer member of the National Precast Concrete Association (NPCA) and participate in its Plant Certification Program.

B. Manufacturer Qualifications: A manufacturer who has experience in the fabrication of pre-engineered manufactured buildings for a period of 5 years minimum.

C. No alternate building designs to the pre-engineered EASI-SET building will be allowed unless pre-approved by the owner ten (10) days prior to bid date.

1.05 SUBMITTALS

A. Building engineering calculations that are designed and sealed by a State licensed Professional Engineer in which the building will be installed, shall be submitted for approval.

Part 2 – PRODUCTS

2.01 MATERIALS

A. Concrete: Steel-reinforced, 5000 psi minimum 28-day compressive strength, air-entrained (ASTM-C260)

B. Reinforcing Steel: ASTM A615, grade 60 unless otherwise indicated.

C. Post-tensioning Strand: 41K Polystrand CP50, .50, 270ksi, 7-wire strand, enclosed within a greased plastic sheath, (ASTM A416). Roof and floor each to be post-tensioned by a single, continuous tendon. Said tendon shall form a substantially rectangular configuration having gently curving corners wherein the positioning of the cable member results in a pattern of one or more loops and a bisecting of the loop(s). The cable member starts from one corner of the concrete building panel, forms a gentle perimeter loop(s) returning to a point where the cable member entered the concrete building panel. The tendon then turns 90 degrees and follows the cable member(s) to a point midway along the "Y" axis of

the concrete building panel and then turns 90 degrees along the “X” axis of the concrete building panel. This bisects the concrete building panel and crosses the opposite parallel portion of the cable member and exits from an adjacent side of the concrete building panel.

1. If post-tensioning is not used in the roof panel, the following guidelines must be followed to ensure a watertight roof design.

    a. The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.

    b. The entire precast concrete roof panel surface shall be sealed with a .045 EPDM continuous membrane cemented to the concrete with a compound designed for this purpose.

D. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant for exterior joints. SIKAFLEX-15LM elastic sealant for interior joints.

E. Panel Connections: All panels shall be securely fastened together with 3/8” thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A283, Grade C and powder coated after fabrication. All fasteners to be ½” diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be Meadow-Burke #FX-19, or equal. All inserts for corner connections must be fastened directly to form before casting panels. No-floating-in of connection inserts shall be allowed.

2.02 ACCESSORIES

A. Doors and Frames: Shall comply with Steel Door Institute “Recommended Specifications for Standard Steel Doors and Frames” (SDI-100) and as herein specified. The building shall be equipped with one (1) double set 3’-0” x 7’-0” x 1 ¾”, 18 gauge galvanized active metal doors with 16 gauge galvanized frame. Doors and frame shall be bonderized and painted one coat of rust inhibitive primer and one finish coat of enamel paint, Owner to select standard available color.

B. Door Hardware:

1. Hinges: McKinney TA2314 4-1/2” x 4-1/2” NRP (non-removable pin) x 32D, 3 per door, or equal
2. Lock Set: Schlage B660P6 x 12-296 x 10-087 x 626 Heavy Duty Commercial Grade Cylinder Deadbolt, or equal
3. Pull Plate: Rockwood 107 x 70C x Type 1 x US32D, or equal
4. Push Plate: Rockwood 70C-RKW x US32D, or equal
5. Door Holder: Rixson 9-326 x 630, or equal (inactive door)
6. Door Closer: Norton 8501 x 689, or equal (Restrooms)
7. Threshold: Pemko 171A x 72”w x A, or equal
8. Drip Cap: Pemko 346C x 76”w x C, or equal
9. Door Sweep: Pemko 315CN x 36”w x C, or equal
10. Surface Bolts: Rockwood 580-8 x US26D, or equal

11. Astragal: Pemko 357C84 x C, or equal

2.03 PLUMBING

A. The following fixture shall be wall mounted with piping through the wall into the building interior. A penetration will be provided in the building floor for entrance of plumbing utilities. The fixtures shall be as follows:

1 – Woodford B26-1/2- RB Mild Climate recessed hose bib with locking cover, or equal

2.04 ELECTRICAL

A. All equipment and conduit shall be surfaced mounted. The load center will be located in an area designated by Owner. All branch conduit and wiring shall be run to the load center. The connection of electrical utilities to the load center is by others. A penetration will be provided for entrance of electrical utilities into the building interior. The electrical components shall be as follows:

1 – Square-D Q0140M100 load center single phase, 100-amp, 120/240 volt, or equal

4 – Columbia Lighting LAW4-40ML-EDU 4’ non-vandal resistant light fixture, or equal

4 – Raab Lighting Slim 12/PC Exterior light with photocell, or equal

1 – Leviton 1221-21 Single Pole Switch, or equal

3 – Leviton GFNT2-I 15-amp GFCI Receptacle, or equal

2.05 FINISHES

A. Interior of Building: Smooth steel trowel finish on all interior panel surfaces. The interior surfaces shall remain natural color concrete.

B. Exterior of Building: Smooth steel form finish on all exterior panel surfaces. The exterior surfaces shall remain natural color concrete.

C. Floor finish: Smooth steel form finish. The surface shall remain natural color concrete.

Part 3 – EXECUTION

3.01 SITE PREPARATION (Standard Preassembled Building)

A. Foundation shall be designed in accordance with local building code and soil conditions. The building shall bear fully on firm undisturbed soils with an approved fill or pad. The EASI-SET™ Building shall at a minimum bear fully on a crushed stone base that is at least two feet larger than the length and width of building

B. Stone shall be a minimum of 8” thick down to firm subgrade. The vertical soil capacity under stone shall be compacted to have minimum bearing of 1,500 pounds per square foot. Stone shall be ¾” clean or smaller, and topped with 2” of sand or screenings; and must be screed level within ¼” in both directions. Stone shall be placed within a perimeter form with flat and level top edge for screeding. Forming material shall remain around stone until after the building is set.

C. The crushed stone base shall be kept within the confines of the soil or perimeter form. Do not allow the base to become unconfined so that it may wash, erode or otherwise be undermined.
D. Or if the building is placed on pavement or a concrete slab, substrate below pavement or slab must have a vertical soil capacity of 1,500 pounds per square foot. Place stone or sand to 1” above highest point of area where building will be placed and at least 1’-0” wide all-around building footprint. Retain stone or sand with a perimeter form to prevent the material from washing out.
E. No building shall bear directly on rock. Where rock is closer than 2 feet from the bottom of the building floor slab or foundation slab, it shall be undercut to a minimum of 2 feet below the building and replaced with approved fill material.
F. Provide positive drainage for the fill, pad, or slab as required.
G. A vapor barrier of 6 mil polyethylene shall be placed between the fill, pad, or foundation slab, and the floor slab where moist conditions exist.

3.02 ACCESS

A. Contractor to provide level unobstructed area large enough for crane and tractor-trailer to park adjacent to pad. Crane must be able to place outriggers within 3’-0” of edge of pad and truck and crane must be able to get side-by-side under their own power. No overhead lines may be within 75’ radius of center of pad. Firm roadbed with turns that allow 65’ low-bed tractor and trailer access must be provided directly to site. No building shall be placed closer than 2”-0” to an existing structure.

END OF SECTION

SECTION 32 13 14 - CONCRETE CURBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construct City of Philadelphia Type B concrete curb in accordance with City of Philadelphia, Department of Streets Drawing No. SC0102, depressed, curved, or straight, at locations indicated on the drawings or as directed by the Engineer.

1.2 REFERENCES

A. PennDOT Specifications Publication 408 (latest revision).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: 4000 psi in accordance with Section 704, PennDOT 408.

B. Expansion Joint Material: Section 705.1, PennDOT 408.

C. Curing Compound: Section 711.2(a), PennDOT 408.

PART 3 - EXECUTION

3.1 PROCEDURE

A. Section 630.3, PennDOT 408, with the following additions:

1. Concrete may be placed in the forms in one lift provided there are sufficient personnel and equipment on the project to thoroughly consolidate the concrete.
2. Curing compound shall be applied to the top of the curb before any marked dehydration of the concrete surface occurs. The forms shall be removed within 24 hours and all exposed concrete surfaces cured.
3. When directed, the Contractor shall provide additional protection by covering the curb with salt hay at his expense

END OF SECTION 32 13 14

SECTION 321315 CONCRETE SIDEWALK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work required under this section consists of furnishing all labor, materials, equipment, services and related items necessary to complete concrete sidewalk paving, and all related work. Complete, as indicated on the drawings or specified herein.

1.2 RELATED SECTIONS

A. Section 321314 – Concrete Curbing

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with all applicable portions of the Pennsylvania Department of Transportation (PENNDOT) Standard Specifications.

2. Comply with applicable standards of the American Concrete Institute.

1.4 SUBMITTALS

Furnish samples, manufacturer's product data, test reports, and materials' certifications as required.

1.5 JOB CONDITIONS

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Materials

Shall meet the requirements specified in Concrete Work in Section 033000.

B. Form Materials

Shall meet the requirements specified in Concrete Work in Section 033000.

C. Expansion Joints

Shall meet the requirements specified in Concrete Work and Sealants & Caulking in Section 033000.

D. Curing

Membrane forming curing and sealing compound or moist curing methods. Refer to Concrete Work in Section 033000.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. On Crushed Stone Subbase

1. Remove loose material from compacted Crushed Stone Subbase surface immediately before placing concrete.

2. Proof-roll prepared Crushed Stone Subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3. All subgrades under paving and other work of this section must be brought to maximum density before placement of any paving work or materials. Do not place any paving materials until all subgrades over which they are to be installed have been brought to satisfactory density.

3.2 FORM CONSTRUCTION

A. Set forms to required grades and lines, rapidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least twenty-four (24) hours after concrete placement.

B. Check completed formwork for grade and alignment to the following tolerances:

1. Top of forms not more than 1/8" in ten (10') feet.

2. Vertical face on longitudinal axis, not more than 1/4" in ten (10') feet.

C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 CONCRETE PLACEMENT

A. General

Comply with applicable requirements of Division 03 Sections for mixing and placing concrete.

B. Do not place concrete until forms have been checked for line and grade. Moisten subbase course if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete using methods which prevent segregation of mix.

D. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, or side forms. Use only square-faced shovels for hand spreading and consolidation.

E. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

F. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than one-half (1/2) hour, place a construction joint.

3.4 JOINTS

A. General

Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints

Provide weakened-plan (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth as shown on the drawings.

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finish edges with a jointer.

C. Construction Joints

Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than one-half (1/2) hour, except when such placements terminate at expansion joints. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

D. Expansion Joints

1. Provide expansion joints at locations shown on the drawings including joints abutting concrete curbs, inlets, structures, and other fixed objects, unless otherwise indicated.

2. Place expansion joints at thirty (30') feet o.c. maximum in sidewalk areas.

3.5 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a ten (10') foot straightedge. Distribute concrete as required to relieve surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, with a light broom finish as shown on the drawings.

D. Do not remove forms for twenty-four (24) hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the Construction Manager.

3.6 CURING

A. Protect and cure finished concrete paving, complying with applicable requirements of Division 03 Sections. Use membrane-forming curing and sealing compound or approved moist curing methods.

3.7 REPAIRS AND PROTECTIONS

A. Repair and replace broken or defective concrete, as directed by the Construction Manager, and where shown on the drawings.

B. Protect concrete from damage until acceptance of work. Exclude traffic from sidewalk for at least fourteen (14) days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

C. Sweep concrete pavement and wash free of stains, discoloration, dirt and other foreign material just prior to final inspection.

TECHNICAL SUBMITTAL REQUIREMENTS
PORTLAND CEMENT CONCRETE SIDEWALK PAVING

ITEM	SUBMITTAL	CATEGORY		
		A	I	S
1	Manufacturer's product data	●		
2	Manufacturer's test reports	●		
3	Materials	●		
4	Certificates		●	

A = For Approval **I** = For Information **S** = Sample

END OF SECTION

SECTION 321373

PAVEMENT JOINT SEALANTS

PART1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

B. Related Sections include the following:

1. None.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and experienced in installation of joint sealants.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1. Submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Owner’s Representative from manufacturer's full range. Color selected may vary to match different selected pavements, i.e. concrete, exposed aggregate concrete or bluestone paving.

2.3 COLD-APPLIED JOINT SEALANTS

A. Provide a premium-grade, high-performance, moisture-cured, 1-component, polyurethane-based, non-sag elastomeric sealant meeting federal specification TT-S-00230C, Type II, Class A. Meets ASTM C-920, Type S, Grade NS, Class 25, use T, NT, O, M, G, I; Canadian standard CAN/CGSB 19.13-M87

1. Provide one of the following Available Products, or an Owners Representatives accepted equal:

a. Sika Corp. Sikaflex 1A
b. Sonneborn Sonolastic SL1

2. Color to be selected by Owners Representatives from samples provided by the Contractor.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install joint sealants to all work prior to the area being made available for public use to prevent smearing or tracking of un-cured sealants.

C. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

D. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

G. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

H. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 321813 - SYNTHETIC TURF

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, tools and equipment necessary to install all synthetic turf as indicated on the plans and as specified herein and other related specifications. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

B. Related Sections:

1. Division 31 Section "Earth Moving"
2. Division 33 Section "Storm Drainage"

1.2 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

B. ASTM – American Society for Testing and Materials.

1.3 SUBMITTALS

A. Submittals shall be provided to Architect, Engineer, and Owner for approval.
B. Shop Drawings:
1. Field layout including all line packages, logos, and lettering.
2. Roll/ Seaming Marking Plan
3. Show installation methods and construction indicating field-verified conditions, clearances, measurements, terminations, drainage including any details of construction that deviate from the plans and specifications.
4. Football turf system (2.25" turf system)
5. Subdrainage system layout and details.
6. Plan drawing showing location of permeability testing of aggregate base.

C. Product Data:
1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
3. Submit data in sufficient detail to indicate compliance with the contract documents.
4. Submit manufacturer's instructions for installation.
5. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.
6. Submit product data sheets for the following:
a) Permeable Liner

b) Subdrain System and all standard fittings
c) Collector Drain.
d) Permeable Stone Aggregate Base Course

D. Samples:
1. Submit one 12x12 inch (minimum) loose carpet sample without infill. Loose sample should demonstrate seaming and include an inlaid line.
2. Submit a sample of sand infill and a sample of selected infill and a sample of the final sand/selected infill mixture, including ratio by volume and by weight equivalent per square foot and method of installation. Sample of each shall represent the exact quantity per square foot. Particle size gradation charts must also be included.
3. Underlayment: One 12x12 inch (minimum) piece of permeable resilient polypropylene drainage layer.

E. Product Certification:
1. Submit manufacturer's certification that products and materials comply with requirements of the specifications.
2. Submit test results indicating compliance with Reference Standards.
3. Submit certificates certifying that all materials used in the permeable aggregate base course work are as specified; submit all sieve gradations etc.

F. Project Record Documents: Record actual locations of seams, drains and other pertinent information in accordance with Division 1 Specifications Series, General Requirements.

G. List of existing installations: Submit list including respective owner's representative and telephone number.

H. Warranties: Per section 1.12, Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.

I. Submit a written "Certification of Acceptance of the Base Construction" from the manufacturer of the infill turf system prior to installation of the synthetic turf system.

J. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:
1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
2. Primary & Secondary Backing Weights, ASTM D5848.
3. Tuft Bind, ASTM D1335.
4. Grab Tear Strength, ASTM D1682 or D5034.
5. Shock Attenuation, ASTM F1936
6. Water Permeability, ASTM D4491
7. Lead Content, ASTM F2765

K. Prior to Final Acceptance, the Contractor shall submit to the Owner:
1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventive maintenance of the turf system, including painting and markings.
2. Project Record Documents: Record actual locations of seams, drains or other pertinent information.
3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer and Insurance

Carrier. Submit information confirming that 3rd Party Insurance Policy, non-cancelable and pre-paid, is in effect covering this installation, and underwritten by a Best "A++" Rated Insurance Carrier. Insurance carrier must confirm that the policy is in force and premiums paid. (See Section 1.12)

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Contractor and/or the Turf Manufacturer:

1. Must be experienced in the manufacture and installation of this type of tall pile synthetic infill turf systems as outlined below:

a) A minimum of twenty-five (25) multi-purpose fields installed of 65,000 square feet or more in the United States, using the specified fiber.

B. Turf Contractor/ Installer Qualifications: Company specializing in performing the work of this section.

1. The Synthetic Turf Contractor shall have experience of twenty-five (25) acceptable installations (minimum 65,000 sq.ft.) of fields that are at least eight years old. Submit a list of all applicable installations with the bid, including dates of install, owner contact info and phone numbers with the bid.
2. The designated Supervisory Personnel on the project must be certified, in writing by the Turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the infill mixture with a minimum of 5 years of experience in turf installations.
3. Installer shall be certified by the manufacturer and licensed.
4. The Manufacturer shall have a representative visit the site to certify, in writing, the installation and Warranty compliance.

C. Prior to the beginning of installation of synthetic turf, the installer shall inspect the sub-base. The installer will accept the sub-base in writing when the base contractor provides test results for compaction, planarity and permeability that are in compliance with the synthetic turf manufacturer's recommendations.

D. Pre-Installation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:

1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner's representative, and the Architect.

E. The Turf Contractor shall provide the necessary testing data to the owner that the finished field meets the required initial shock attenuation, as per ASTM F1936.

1. Shall provide third party certification confirming minimum requirement of 9 lbs. tuft bind.

F. The Owner reserves the right to reject and/ or refuse acceptance of any or all aspects of the synthetic turf installation if it fails to meet the requirements of this specification section.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped condition.

B. Store materials/ products in a safe and secure place, under cover and elevated above grade.

C. Deliver and store components with labels intact and legible.

D. Protect from damage during delivery, storage, handling and installation. Protect from damage by other trades.

E. Inspect all delivered materials and products to ensure they are undamaged and in good condition.

F. Comply with manufacturer's recommendations.

1.6 EXISTING CONDTIONS

A. The contractor shall review and accept existing conditions prior to bidding. The contractor shall again review and accept existing conditions prior to beginning the installation.

B. The contractor shall protect all existing conditions that are not part of the scope of work and repair any damage to existing conditions that occurs during this scope of work.

1.7 SUBDRAINAGE

A. Provide subdrainage system to collect drain-through stormwater and conduct it to dispersal area(s) or manholes as indicated on the drawings

1.8 SUBGRADE VERIFICATION

A. Prior to any permeable aggregate base course construction, check the subgrade for accuracy, uniform bearing strength and crown (slope) toward the subdrainage system as required on the drawings. Verify that all subdrains, utilities, etc. have been properly installed and shall fill and tamp any traces of utility trenches. Maintain all subgrades in a satisfactory condition until superimposed construction is placed. Do not place base on a frozen or muddy subgrade.

3.1 1.9 GRADE CONTROL

A. Establish and maintain the required lines and grades. Provide crown or cross slope as indicated. Adjust the tops of utility/communication structures to be flush with proposed finish turf grades or as appropriate.

B. Subgrade for aggregate base must be established by dual plane laser grading equipment; coordinate with EARTH MOVING section.

3.2 1.10 BASE COURSE THICKNESS

A. Provide the thickness of the stone aggregate course as indicated on the drawings. The thickness indicated is the minimum at any point.

1.11 SEQUENCING AND SCHEDULING

A. Coordinate the Work with installation of work of related trades as the Work proceeds.

B. Sequence the Work in order to prevent deterioration of installed system.

1.12 WARRANTIES

A. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a minimum period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of nature beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; pre-paid for the entire 8 year term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. A rated carrier and must reflect the following values:

1. Must provide full coverage for eight (8) years from the date of Substantial Completion.
2. Must warrant materials and workmanship, including but not limited to, gravel base stability, drainage rates, seaming materials and adhesives.
3. No maximum per claim coverage amount.
4. Minimum of twenty-five-million dollar ($25,000,000) annual aggregate, and a per incident limit of no less than $1 million per claim. The third party insurer must have an AM Best rating of A++ or better.
5. Must warrant that the finished and accepted playing field elevation shall not vary by more than 0.1’ due to instability of the gravel foundation (unrelated to existing, pre- developed subgrade soil conditions) or drainage system and that the field drainage rates will remain at or above design capacity for the life of the warranty.
6. Must cover full 100% replacement value of total square footage installed, minimum of $7.00 per sq. ft. (in case of complete product failure, which will include removal and disposal of the existing surface) The warranty shall include all necessary materials, labor, transportation costs, dumping fees, etc to complete any repairs under such warranty.
7. Must have a provision to either make a cash refund or repair or replace such portions of the installed materials that are no longer serviceable to maintain a serviceable and playable surface.
8. Must be a warranty from a single source covering workmanship and all self-manufactured or procured materials of the turf, turf system, base, and drainage.

9. Warrant that the yarn used to make the grass-like tufts will maintain its UV stability and tensile strength such that the strength of the fiber when measured in accordance with ASTM D-2256 will not decrease by more than 50% during the warranty period due to breakdown of UV stability.
10. Policies that include self insurance or self retention clauses shall not be considered.
11. Sample policy must be provided at time of bid to prove that policy is in force. A letter from an agent or a sample Certificate of Insurance will not be acceptable.

B. The warranty coverage shall not place limits on the amount of the field's usage.

C. The synthetic turf system must maintain a G-max of less than 120 for the life of the Warranty as per ASTM F1936. The manufacturer's warranty shall include annual G-Max Testing.

D. Permeable Resilient Polypropylene Drainage Base

1. Sports field underlayment panels shall be warranted by the manufacturer against warping, cracking, shattering, splitting or deteriorating. They shall not displace turf, deform, buckle from heat or moisture, or form gaps in cold or dry conditions that can be seen through the turf, under normal and proper use. They shall be free from defects in material and workmanship for a period of twenty (20) years after date of installation.
2. The Panels shall not compress by more than ten percent (10%) during the Warranty Period unless they are subjected to stress loads in excess of those that ordinarily occur during use for athletic performance [35 pounds per square inch].

1.13 MAINTENANCE SERVICE

A. Contractor shall train the Owner's facility maintenance staff in the use of the turf manufacturer's recommended maintenance equipment.

B. Manufacturer must provide maintenance guidelines and a maintenance video to the facility maintenance staff.

1.14 TESTING

A. Turf Manufacturer shall be responsible to provide independent laboratory G-max testing (ASTM 355, 1936 method) at substantial completion, to verify that the shock attenuation properties of the field meet the requirements set forth in this specification.

1. The field must maintain an ASTM F1936 G-max of less than 120 for the life of the Warranty.

2. In addition to testing at time of completion, the Turf Manufacturer shall be responsible for annual Gmax testing as described above at its own cost. If at anytime the G-max ranges reach unacceptable levels, it is the responsibility of the Turf Manufacturer (or its 3rd party warranty) to bring the field back into the required ranges at no cost to the Owner.

B. Turf Manufacturer shall be responsible to provide independent laboratory Lead Content testing prior to substantial completion and final acceptance by Owner.

1. Two representative samples of fiber(s) and locations on the field shall be tested by the test methods below. The total lead content measured shall be less than 300 mg/ kg (ppm). Sample locations shall be chosen by the Owner.

    a. The testing shall be conducted by an independent environmental laboratory accredited for heavy metal testing in solid and hazardous waste.

    b. Prepare samples as outlined in EPA Method 3052 with the temperature modified from 180 +/- 5 deg C to 210 +/- 10 deg C.

    c. Analyze prepared samples for lead using inductively coupled plasma- atomic emission spectrometry (AAS) as outlined in Test Method E 1613.

    d. Report total lead content as mg/kg (ppm).

C. Turf Manufacturer shall be responsible to provide independent drainage testing of installed field gravel base and turf carpet with infill prior to substantial completion and final acceptance by Owner. The combined tests shall prove installed artificial turf system's drainage capability shall allow water flow through the system at a rate of not less than 10 inches per hour.

1. ASTM test WK22081- Test Methods for Vertical Permeability of Synthetic Turf Sports Field Base Stone and System by Nonconfined Area Flood Test Method. This test does not require special equipment and can be done in the field to test the vertical permeability before the synthetic turf is installed and after installation of the base is complete. This method does not require the application of a head and more accurately mimics rainwater conditions..

2. ASTM F1551 -Water Permeability of Synthetic Turf Systems and Permeable Bases. Test will provide permeability of synthetic turf carpet with infill.

3. Provide written report of permeability of base, and carpet with infill over base. Report shall include inches per hour rate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The component materials of the synthetic turf system consist of:

1. A carpet made of dual filament polyethylene fibers (spinneret, extruded) tufted into a backing. All backing must meet the drainage requirements below.

2. All proposed synthetic turf systems shall be a 50/50 blend of arched monofilament yarn, having a 230 to 300 micron thickness and a nominal filament width of 1.5mm inter-tufted with a 100 micron parallel fibrillated slit film yarn. Turf carpet shall have a minimum stitch (tufting) gauge of 1/4” and a maximum stitch gauge of 1/2”. All fibers shall be polyethylene or co-polymer fiber tufted into a permeable backing system, and coated with a secondary backing of high-grade polyurethane.

3. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified should be able to withstand full climatic exposure in all climates, be resistant to insect infestation, rot, fungus, mildew, ultraviolet light and heat degradation, and shall have the basic characteristics of flow-through drainage, allowing free movement of surface runoff through the synthetic turf fabric where such water may flow to the existing base and into the field drainage system.

4. The finished playing surface shall appear as mowed grass (except for the baseball infield, which shall appear as shorter, red-clay-colored grass blades) with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use. The pitcher's mound, batter's boxes, and basepaths shall include removable turf sections to allow for replacement and repair of worn or damaged sections.

5. Glue, thread, paint, seaming fabric and other materials may be used to install and mark the artificial turf. All adhesives used in bonding the system together shall be resistant to moisture, bacterial and fungus attacks, and resistant to ultraviolet rays at any location upon installation.

6. Field shall consist of a line package with the following four (4) sports:

   a. Football
   b. Soccer
   c. Baseball
   d. Softball

B. The installed artificial grass fabric system shall have the following specified properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	>10000 nominal
ASTM D3218	Yarn Thickness	>100 microns (slit); >230 microns (mono)
ASTM D2256	Yarn Breaking Strength	>8 lbs. (slit); >25lbs (mono)
ASTM D5793	Stitch Gauge	min. 1/4"- max 1/2"
ASTM D418/D5848	Pile Height	2.25" min.
ASTM D5848	Pile Weight	min. 44 oz. / square
yard ASTM D5848	Primary Backing	min. 6 oz. / square yard
ASTM D5848	Secondary Backing	min. 20 oz. / square
yard ASTM D5848	Total Weight	min. 70 oz. / square
yard ASTM D1335	Tuft Bind (without infill)	min. 9 lbs.
ASTM D1682/D5034	Grab Tear (width)	200 lbs. force
ASTM D1682/D5034	Grab Tear (length)	200 lbs. force
ASTM F1015	Relative Abrasiveness Index	<25
ASTM D4491	Carpet Permeability	>30 inches / hour
ASTM F355/F1936	Impact Attenuation, Gmax	90 min. – 120 max. at installation; 90 min. – 120 max. over field life (including pad beneath)

C. The Carpet shall consist of fibers tufted into a primary backing with a secondary coating.

1. Synthetic turf shall be loose-laid across the field, stretched, and attached to the perimeter edge detail. Synthetic turf shall be of sufficient length to permit full cross-field installation. No head or cross seams will be allowed except as needed for inlaid fabric striping or to accommodate programmed cut-outs.

2. All seams shall be flat, tight, and permanent with no separation or fraying. Edges of all panels must be cut and discarded prior to being joined together. Inlaid markings shall be adhered to seaming tape with a high strength polyurethane adhesive applied per the Synthetic Turf Manufacturer's standard procedures for outdoor applications. All main fabric seams shall be transverse to the field direction (i.e. run perpendicularly across the field).

3. Porous Backing:
   a. Primary backing shall be double-layered polypropylene fabric treated with UV inhibitors.
   b. The secondary backing shall consist of an application of porous, heat- activated urethane to permanently lock the fiber tufts in place.

   Perforated Backing:
   a. The primary backing shall consist of two layers of woven fabric and one layer of non-woven fabric.
   b. The secondary backing of high-grade polyurethane shall be applied to the primary backing at a minimum of 20 oz./yd. Secondary backing adds resistance to water degradation and strengthens grip on fibers.
   c. The entire backing shall be coated with holes perforated throughout the backing at a minimum 3" interval to allow for drainage. Partially coated materials shall not be acceptable.
   d. Hole spacing must allow for water drainage of a minimum of 30" an hour. The 30" per hour must account for infill blockage. Turf manufacturer must submit product data for hole spacing and hole size for rate of permeability.

D. The Infill materials shall be as approved by the Manufacturer and as per the following specifications: The Infill shall consist of a resilient granular system, comprised of selected/graded dust-free silica sand or mineral aggregate and rubber granules. The infill may be a homogeneous mixture of sand and rubber or installed as a layered system per the manufacturer. The silica sand component of the infill shall represent 50% of the total infill, by weight. Total infill amount shall be approx. 10.0 lbs. per square foot but not be less than 9.0 lbs. per square foot (depending on manufacturer stitch gauge) to achieve a +/-
2.000 inch infill depth.

1. Rubber: The rubber shall be dust and contaminant free. Recycled tires shall not be used. The clean, uniformly sized particles shall be consistent in shape and particle size distribution.
2. Sand: Silica Sand shall be whole and not conglomerated or grounded. The shape of the sand particles shall be rounded or sub-angular so as to minimize abrasion to field users and synthetic turf fibers. Size of sand shall be per manufacturer based on selected infill and based on performance of sports specified herein.
3. The particles shall resist abrasion in high traffic and excessive wear

applications and provide stability to artificial sports turf applications.

4. The particles shall be structurally pure and consistently uniform in size distribution for predictable performance.

E. Permeable Polypropylene Drainage Base:

1. Athletic field synthetic underlayment, a molded polypropylene base composite material designed specifically for use with synthetic infill turf.
2. Underlayment shall ensure safety of the playing surface (impact attenuation/shoe traction) and high capacity subsurface drainage of the installed playing field.
3. Shall be composed of expanded Polypropylene edge interlocking panels with molded Impact-absorbing pistons and bi-directional channel drainage system
4. Description: The specified material must have both impact absorption and drainage properties that meet the following performance requirements.

Standard	Property	Specification
FIFA 1 and 2 Star		Meets requirements with approved synthetic infilled turf
	Density	3.63 lbs. / cubic ft. (58.2 grams / liter)
EN12616	Vertical drainage	200” per hour
	Surface contact	50% minimum with synthetic turf backing
ISO 8295	Friction coefficient	movement of artificial turf over 50mm distance 8.92N maximum force
ASTM D4716	Lateral drainage	0.00583 m2/sec @ 0.5% slope
ISO 4897	Thermal stability	not to exceed 3mm per 30 degree C change
ISO 8301, EN 12664/7	Thermal resistance (R Value)	minimum 0.6
ISO 1798	Tensile strength	min 700 Kpa or 110 psi
ASTM F355	G-Max; system test under infill turf	120G maximum average
EN 14809	Shock Absorption	60-70%
EN14809	Vertical Deformation	<4mm
ISO 1856C	Compression set - 25% strain, 22hrs, 23°C after 24 hrs.	9% (0.083 “)
	Repeated impact compression resistance	7.45kg/cm2 or 106psi, repeated load, 10,000 cycles system test with infill turf; not to exceed 3%
ASTM G22-76/G21-96	Bacteria and Fungi resistance	Pass

ESSM 105d/1997	Environmental testing-ground water protection	Pass
ASTM F925	Chemical Resistance to the following: Gasoline, Brake Fluid, Chlorine, Underbody coating, Transmission Fluid, Motor Oil, Zinc Chloride, Tar and Oil Solvents, Windshield Washer Fluid, Kerosene, Ethylene and Propylene Glycols	no change to material

5. Material shall be 100% recyclable; recycling for energy not acceptable.

6. Material shall be manufactured in an ISO-9000 certified facility.

F. Aggregate Base Course

1. To guarantee structural stability it is important that both gradations meet the following criteria:
   100% Fragmentation
   $D_{60}/D_{10} > 5$
   $1 < D^2_{30}/D_{10}/D_{60} < 3$

2. To guarantee separation between finishing stone and base stone, it is important that the gradations meet the following criteria:

   $D_{85\ \text{FINISHING COURSE}} / D_{15\ \text{BASE COURSE}} > 2$
   $3 < D_{50\ \text{BASE COURSE}} / D_{50\ \text{FINISHING COURSE}} < 6$

3. To guarantee proper drainage both stones should meet the following criteria when saturated and compacted to 95% Proctor:
   Permeability > 10 in/hr (7x10-3 cm/sec)
   Porosity > 25%
   "Dx" is the size of the sieve (in mm) that lets pass x% of the stone. For example: D60 is the size of the sieve that lets 60% of the stone pass. These sizes, for calculation purposes, may be obtained by interpolation on a semi-log graph of the sieve analysis.

4. Aggregate Base shall be AASHTO #57 Stone to be used.

5. Leveling Layer (AKA D85 or Finish Stone):

   a. Product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Material shall consist of sound, tough, durable, angular stones, free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, limestone, marble, mud, dirt, organic matter, or other deleterious material. The presence of soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, feldspar, limestone, marble, mud, dirt, organic matter, or other deleterious material will be cause for rejection at Engineer's discretion.

   b. Testing and evaluation of material by the testing laboratory shall evaluate material composition for the presents of feldspar or micaceous materials and note same on testing report. Material may be rejected due to the presence of feldspar or micaceous materials.

   c. Test for Resistance to Abrasion, ASTM C131. Materials shall show a loss on abrasion of not more than 20%. C. Soundness, ASTM C88. Coarse aggregate shall not have a loss of more than 15% at the end of five cycles.

6. Stone Gradation Specifications:

Sieves	#57 Base Layer AVG % PASSING	Leveling Layer (AKA Finish Stone or D85 Stone) AVG % PASSING
1½" or 38mm	100	-
1" or 25mm	95 +/-5	-
¾ or 19mm	-	-
½" or 12.5mm	43 +/-17	100
3/8" or 9.5mm	-	85-100
¼" or 6.3mm		75-95
US #4 or 4.76mm	Max. 7	60-85
US #8 or 2.38mm	Max. 3	35-70
US #16 or 1.19mm	-	10-45
US #30 or .595mm	-	5-15
US # 40 or .420mm	-	0-10
US #100 or .149mm	-	0-5
US #200 or .074mm	-	0-2

2.2 PERFORATED UNDERDRAIN

A. Basis-of-Design Product: Subject to compliance with requirements, provide 4" horizontal perforated geotextile-wrapped underdrain system.

B. Product Requirements:

1. The underdrain system shall be of flexible, prefabricated, rounded, perforated composite product. Nominal Size: 4 inches high by approximately 3/8 inches thick. The underdrain system shall be made of a high-density polyethylene. The underdrain piping shall be constructed using corrugated pipes that define and provide the flow channels and structural integrity of the drain. The geotextile shall function only as a filter. The collection system pipes shall conform to the following physical property requirements:

Thickness, inches	ASTM D-1777	0.8
Flow Rate, gpm/ft	ASTM D-4716	30
Compressive Strength, psf	ASTM D-1621 (modified sand method)	6000

2. The collection system shall be wrapped with a non-woven geotextile and shall be a non-woven needle-punched construction and consist of long-chain polymeric fibers composed of polypropylene, polyethylene or polyamide. The fibers shall be oriented

into a multi-directional stable network whereby they retain their positions relative with each other and allow the passage of water as specified. The fabric shall be free of any chemical treatment or coating, which reduces permeability and shall be inert to chemicals commonly found in soil. The geotextile shall conform to the following minimum average roll values

Weight	ASTM D-3776	4.0
Tensile Strength	ASTM D-4632	120
Elongation %	ASTM D-4632	50
Puncture, lb	ASTM D-751	50
Mullen Burst, psi	ASTM D-3786	225
Trapezoidal Tear, lb	ASTM D-4533	42
Coefficient of Permeability	ASTM D-4491	.1 cm/sec
Flow Rate, gpm/ft2	ASTM D-4491	95
Permittivity, 1/sec	ASTM D-4491	1.8
Apparent Opening Size	ASTM D-4751	70 Max. US Std Sieve Opening
Seam Strength, lb/ft	ASTM D-4595	100
Fungus	ASTM G-21	No growth
UV Resistance after 500 Hrs	ASTM-D4355	70% minimum

4. The fittings used with the collection system shall be of a "snap together" design. In no case shall any product be joined without the use of the manufacturer's connector designed specifically for the purpose.

2.3 COLLECTOR DRAIN PIPE SYSTEM

A. The Contractor shall provide the Owner the following materials:

1. AASHTO M 252, Type CP; smooth interior, corrugated exterior double-wall, for coupled joints.
2. Couplings: Manufacturer's standard, band type.
3. Filter Fabric: Nonwoven, needle-punched Geotextile.

2.4 ADDITIONAL MATERIAL

A. The Contractor shall provide the Owner the following materials:

1. Turf fabric two hundred square feet (200) to be used for emergency repairs of turf. Owner to set forth min size requirements during submittal phase.
2. All usable remnants of new material shall become the property of the Owner and may satisfy the 200 square feet requirement.
3. In-fill material as required to fill two hundred square feet (200). This material may not be used by the Contractor as top dressing as required to maintain depth and Gmax values during the warranty period.

2.5 FIELD MAINTENANCE EQUIPMENT

A. The following field maintenance equipment shall be provided to the Owner, in a fully operational and assembled state, with proper manuals, instruction to the Owner’s maintenance staff prior to final acceptance of the project.

1. Four-wheel utility vehicle, equal to John Deere TX 4x2 or equivalent.

https://www.deere.com/en/gator-utility-vehicles/traditional-gators/tx-4x2-utility-vehicle/

2. Snow plow compatible with and for attachment to the Four-Wheel Utility Vehicle. Equal to the Meyer Utility Vehicle 6' Drive Pro Angling Snow Plow with Rec Hitch:

   https://www.meyerproducts.com/snow-plows/contractor-off-road-plows/utility-vehicle-snow-plow

3. Field sweeper device for use on an infill synthetic turf system, to be attached to the Four-Wheel Utility Vehicle. Equal to the Greens Groomer LitterKat Synthetic Turf Sweeper:

   http://www.greensgroomer.com/LitterKat.html

PART 3 - EXECUTION

3.3 GENERAL

A. The installation shall be performed in full compliance with approved shop drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer/manufacturer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. Manufacturer of Pad shall provide supervision for pad installation. Pad Manufacturer must approve pad installation prior to installation of synthetic turf carpet.

3.4 SUBGRADE

A. Subgrade for installation of permeable aggregate base course and synthetic turf as required in the Earthwork section of these specifications and as set by the approved drawings.

B. Proof roll subgrade in accordance with the Earthwork specifications and correct unacceptable subgrade as specified.

C. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

D. Locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services

3.5 INSTALLATION OF PERMEABLE LINER

A. Verify that surface elevations of finished subgrade conform to elevations shown on Drawings prior to underdrain system construction and that the subgrade surface is uniform and free of depressions, voids, and irregularities. Install permeable liner in accordance with liner manufacturer's written recommendations.

1. Overlap joints a minimum of eight inches. Overlap all laps in direction the stone aggregate is to be spread.
2. Securely bond joints in accordance with the liner manufacturer's recommendations. Joint bonding may be delayed until aggregate placement is completed to minimize joint stress.
3. Place a suitable amount of ballast on liner to prevent movement by wind. Form ballast to not damage liner.
4. Do not permit direct loading on the fabric by traffic.
5. Repair punctured or torn fabric by overlapping additional fabric and jointing in accordance with manufacturer's recommendations.
6. Completely cover collector drain trench with liner.

3.6 PERMEABLE AGGREGATE BASE COURSE

A. Moisture Content: Provide aggregate that contains 3.5% to 4.0% moisture content to ensure that fines do not migrate and to facilitate proper compaction. Ensure that aggregate leaving the source plant meets this requirement and is required to apply water to aggregate on site to attain and maintain this minimum moisture content.

B. Placement: Prior to aggregate placement, remove any excess or contaminated backfill from the drainage trenches or subgrade. Provide a subgrade surface free of standing water prior to aggregate placement.

1. Place the aggregate in a minimum two (2) lifts, each three (3") in compacted depth.
2. Spread each layer uniformly with equipment that will not cause perceptible separation in gradation (segregation of the aggregates), preferably by a self-propelled paving machine.
3. Should a separation of the materials or particles occur during any stage of the spreading or stockpiling, immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further separation.
4. Utilize a laser plane control system for the grading of the permeable aggregate to ensure accuracy in the grade tolerances.

C. Compaction

1. Compact each layer to a minimum density of not less than 95% of maximum dry density as determined by ASTM 0698 and measured using a nuclear method.
2. Proof roll and mark "soft spots" for additional compaction. Use static tandem drum-type roller of not less than five (5) tons weight.

D. Surface Tolerance

1. Do not deviate from the tolerance of the finished surface (tolerance-to-grade) from designated compacted grade. Do not deviate more than 1/8" in 10' (any direction) when placed under a 10 foot long straight edge. This tolerance is required over the entire field.

2. Mark areas that deviate with spray paint and correct with 1/4” limestone or similar chips and rolled tight to achieve density. Perform remedial actions by hand.

3.7 SUBDRAIN INSTALLATION

A. Inspect delivered subdrain piping. Do not use damaged subdrains in the work.

B. Install as detailed on drawing and per manufacturer’s written instructions.

C. All ends/joints of any open geotextile fabric must be completely taped closed with 2” wide (minimum) duct tape or the underdrain manufacturer’s PVC tape to prevent any soil fines from entering the drain system. Tape all joints at:

1. Ends of perforated drain.
2. End of drain at collector/header pipe.
3. End of drain at fittings.
4. Any tear, rip or damage to the geotextile fabric.
5. Any additional openings of the geotextile fabric

3.8 COLLECTION DRAIN INSTALLATION

A. Install collector drain pipe where shown and as detailed on the drawings. Provide watertight connections at existing inlets/manholes/cleanouts and/or piping.

3.9 TESTING OF INSTALLED AGGREGATE DRAINAGE LAYER

A. The permeability of the installed aggregate must be field tested by a third party geotechnical service/testing agency prior to installation of the turf system. Test samples must be taken at one sample minimum per 10,000 SF of surface area. Final in-place aggregate must have a percolation rate of not less than 20” per hour.

B. All test results must be delivered in writing to the Owner, Contractor and Owner’s Representative/Project Engineer. If any areas do not meet the minimum infiltration requirements, the Contractor is responsible for corrective action to improve the infiltration rate including the restoring the stone base to required grade, cross-section and density.

C. When the Contractor has confirmed that the aggregate base is in compliance with all requirements (planarity and elevation verified by a licensed Surveyor and compaction, gradient, and permeability verified by the specified tests) the Contractor to notify the Owner’s Representative/Project Engineer to schedule a final inspection by the Synthetic Turf System Installer. During this inspection, the Contractor shall make available an orbital laser system for checking grades. Any deficiencies uncovered during this inspection must be remedied to the satisfaction of the Synthetic Turf System Installer before the aggregate base will be considered acceptable.

3.10 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Test drain piping and entire drainage system with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Collector drain piping will be considered defective if it does not pass tests and inspections

3.11 EXAMINATION

A. Verify that all sub-base, drainage and leveling is complete prior to installation of synthetic turf.

B. The surface to receive the synthetic turf must be inspected by the Installer, and prior to the beginning of installation, the Installer must accept the sub-base in writing. The acceptance will depend on the base contractor providing the installer with test results indicating that compaction, planarity and permeability are in compliance with the synthetic turf manufacturer's specifications. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process. Acceptance shall be for tolerance to grade (1/4 inch in 10 feet in all directions).

C. The compaction of the aggregate base shall be 95%, according to the Modified Proctor procedure (ASTM D1557), and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 1/4" from design grade. All must be verified by means of ASTM testing and surveys to the satisfaction of the turf contractor and Owner.

3.12 INSTALLATION OF TURF SYSTEM

A. Install in accordance with Manufacturer's instructions. The Turf Contractor shall strictly adhere to the installation procedures outlined under this section. Any variance from these requirements must be accepted, in writing, by the onsite representative of the Manufacturer/Installer, and submitted to the Engineer, Architect, and Owner, verifying that the changes do not in any way affect the warranty or performance of the system. Infill materials shall be approved by the Manufacturer and installed in accordance with the Manufacturer's standard procedures.

B. The carpet rolls are to be installed directly over the properly prepared aggregate base. Extreme care should be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity. It is suggested that a 2.5 ton static roller be placed on site and made available to repair and properly compact any disturbed areas of the aggregate base.

C. The rolls of turf shall be rolled out a minimum of six hours (4 hours if mostly sunny) prior to starting seaming procedures to allow for carpet to expand and relax.

   A. All visible wrinkles shall be stretch out before seaming. If wrinkles cannot be stretched properly, material shall either be removed or allowed to sit long enough to be stretched.
   B. Seams shall be flat, tight and permanent with no separation or fraying.

D. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation (from end to end or side to side). No "head" or cross seams will be allowed. Utilizing standard state of the art sewing procedures, each roll shall be attached to the next.

E. This is basically a sewn installation. Gluing of fabric rolls shall not be acceptable.

Minimal gluing will be permitted and only to repair problem areas, corner completions, and install logos as required by the specifications. All seams shall be sewn using double bagger stitches and polyester thread. Seams shall be flat, tight, and permanent with no separation or fraying.

F. Infill materials shall be applied in thin lifts. The turf shall be brushed as the mixture is applied. The mix shall be uniform and even in thickness to assure proper playing characteristics. The Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional.

G. Synthetic turf shall be attached to the perimeter edge, both glued and nailed, in accordance with the Manufacturer's standard procedures and construction details provided in the Bid Documents.

3.13 SYNTHETIC BASE

A. Job Conditions:

a. Base Acceptance: The Owner and Contractor must jointly approve the base before synthetic drainage underlayment can begin.

b. Do not install surface in temperatures above 90 degrees Fahrenheit.

B. Product Requirements:

a. Obtain and install the product in accordance with written installation instructions from the manufacturer.

b. Use only new materials manufactured and shipped for the specific installation. No used, recycled or refurbished materials are to be installed.

c. Product to be shipped as flat panels on prepackaged pallets. Pallets to be wrapped with heavy-duty barrier for protection from moisture and UV exposure. Do not stack pallets.

C. Installation:

a. Place surface directly onto geotextiles.

b. Install panels perpendicular to the sidelines, in accordance with manufacturer's instructions. When trimming for the edges of the field, panels must be within 3mm (1/8 inch) of the curb in height and distance.

c. Panels shall be fitted together as tightly as possible. Panels are to be overlapped and fit together against the four soft protrusions molded along the overlapping edge of the panels. Panels may have gaps not greater than 3mm (0.125 inch) maximum.

d. Seams should be mechanically fastened by hand without use of additional materials, glue, fasteners or secondary processes and equipment.

D. Turf carpet installation shall begin within 7 days after underlayment installation to avoid prolonged exposure to sun.

3.14 UTILITY COVERS/LIDS

A. Cover all manhole covers/lids and/or any additional utility boxes within the area of the synthetic turf with turf system and infill.

3.15 CLEAN UP AND PROTECTION OF THE SITE

A. Protect installed turf from subsequent construction operations.

B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

C. All usable remnants of new material shall become the property of the Owner.

D. The Contractor shall keep the area clean throughout the project and clear of debris.

E. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

F. Contractor shall be fully responsible for any damages outside the Limits of Disturbance.

END OF SECTION 321813

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
2. Swing gates.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete and post footings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review coordination of interlocked equipment specified in this Section and elsewhere.
3. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

B. Samples for Initial Selection: For each type of factory-applied finish.

C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer factory-authorized service representative.

B. Product Certificates: For each type of chain-link fence, operator, and gate.

C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of gate operators and controls.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

1. Design Wind Load: 30,000 psi yield.

A. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F 1043, Schedule 40 steel pipe.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: 9 gauge.
A. Mesh Size: 2 inch.

B. Vinyl-Coated Fabric: ASTM F-668, Class 24, 0.35 oz./sq. ft..

1. Color: Black, according to ASTM F 934.

C. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

A. Posts and Rails Sheet 28: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:

1. Fence Height: 96 inches As indicated on Drawings.

2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.

A. Line Post: 2-0 inches in diameter.
B. End, Corner, Pull Posts, and Posts Attached to Ball Control Net Posts: 2-7/8 inches in diameter .
C. Gate Posts: 4-0 inches in diameter.

3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F 1043.

A. Top Rail: 1-5/8 inches.
B. Brace Rail: 1-5/8 inches.

4. Brace Rails: ASTM F 1043.

5. Polymer coating over metallic coating.

A. Color: Black, according to ASTM F 934.

2.4 TENSION WIRE

A. Polymer-Coated Steel Wire: 0.177-inch diameter, tension wire according to ASTM F 1664, Class 2a over aluminum-coated steel wire.

1. Color: Black, according to ASTM F 934.

B. Aluminum Wire: 0.192-inch- diameter tension wire, mill finished, according to ASTM B 211, Alloy 6061-T94 with 50,000-psi minimum tensile strength.

2.5 SWING GATES

A. General: ASTM F 900 for gate posts and double swing gate types.

1. Single Gate Leaf Width: 60 inches.
2. Double Gate Leaf Width: 144 inches.
3. Framework Member Sizes and Strength: Based on gate fabric height of 96 inches or less.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
2. Aluminum: ASTM B 429/B 429M; manufacturer's standard finish.
3. Gate Posts: Round tubular steel.
4. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

2.6 FITTINGS

A. Provide fittings according to ASTM F626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading, rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized with coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

a. Polymer coating over metallic coating.

2.7 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

A. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.

2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Engineer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

1. Install fencing where indicated on the Drawings.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at maximum 10 feet o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet.
3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
4. Ground fence on each side of gates and other fence openings.

a. Bond metal gates to gate posts.
b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

D. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

E. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Prepare test reports.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 32 91 13 - SOIL PREPARATION

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 planting soils specified by composition of the mixes:

1. Planting Soil Mix for lawn areas.
2. Planting Soil Mix for landscaped areas.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 329200 "Turf and Grasses" for installation of lawn seed or sod.
3. Section 329300 "Plants" for installation of trees, shrubs, and groundcover.

1.3 REFERENCES

A. ASTM: American Society for Testing Materials: D 1557-91 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

B. USDA: United States Department of Agriculture: Texture Triangle Classification.

1.4 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce topsoil or planting soil.

H. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

I. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

J. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

L. SSSA: Soil Science Society of America.

M. 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.

N. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

O. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

P. USCC: U.S. Composting Council.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Topsoil:

a. Provide source of topsoil.
b. Provide written report of topsoil analysis results and recommendations as outlined in Section 1.9 Testing Requirements.

2. Compost:

a. Provide source and composition of compost.
b. Provide written report of compost analysis, including pH and organic content.

3. Planting Soil Mix:

a. Provide written report of mix analysis.

4. Soil Amendments:

    a. Include recommendations or application and use.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.8 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor or Soil Scientist in presence of Engineer or Landscape Architect, under the direction of the testing agency.

1. Number and Location of Samples: Minimum of three representative soil samples where directed by Engineer or Landscape Architect for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on topsoil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

    a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel)

percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.

b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for

healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials:

1. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
2. Store packaged material with protection from weather or other conditions which would damage or impair the effectiveness of the product.
3. Packaged material which has become wet, moldy, or otherwise damaged in transit or storage will be rejected.

B. Bulk Materials:

1. Store bulk materials in areas as indicated on the plans or as directed by the Engineer/Landscape Architect. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas, plants, or within the drip line of existing trees.
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. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Definition: Per ASTM D 5268. Topsoil shall be acceptable friable loam that is reasonably free of subsoils, clay lumps, litter, roots or other plant materials, stones larger than 1” in any direction, and other foreign materials.

C. Topsoil for Planting Soil Mixes:

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
2. Topsoil shall be fertile, friable natural loam capable of sustaining vigorous plant growth. Furnished topsoil shall meet the following grading analysis:

    a. Particle size

Sieve	Minimum Percent Passing
2"	100
No. 4	75
No. 10	60

    b. Sand, silt and clay material passing the No. 10 sieve shall be present within the following ranges:

	Minimum Percent	Maximum Percent
Sand	30	50
Silt	10	30
Clay	20	50

3. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
4. The topsoil shall be free from subsoil, stones larger than one inch, clods of hard earth, sod, plants or roots, sticks or other extraneous materials. It shall contain no toxic materials. Topsoil from swampy areas or areas of standing water will not be permitted. Do not deliver topsoil in either a frozen or muddy condition.
5. Limestone: Ground limestone shall have a minimum of 85% total carbonates and a minimum of 50% total calcium oxides. At least 90% of it shall be able to pass a No. 20 sieve and at least 50% to pass a No. 100 sieve.
6. Fertilizers: Fertilizer shall be standard commercial fertilizer conforming to the requirements of the Pennsylvania Soil Conditioner and Plant Growth Substance Act of December 1, 1977, P.L. 258, No. 86 (3 P.S. 68.2), as amended and any other applicable State and Federal laws. Quantities as per soil analysis.

    a. Use 20-10-5 (10 gram tablets) slow release, plus iron supplement as required.
    b. Additives: Add in the amount and manner prescribed by the soil analysis.
    c. Organic Matter: On dry weight basis 90% or better pH factor 3.5 - 5.5.
    d. Porous Ceramics: Profile, Isolite or Axis.

D. PLANTING SOIL MIX for lawn and landscaped areas.

1. Planting Soil Mix shall be topsoil amended per the results of the soil analysis to have the following properties. Test the mixture to confirm it meets the specified requirements before placing.

a. Texture of soil shall conform to the classification within the USDA triangle for Sandy Loam or Loamy Sand. Planting Soil Mix shall have the following particle size distribution, as determined by pipette method in compliance with ASTM F-1632:

Sand:	40% to 60%	(0.05mm to 2 mm)
Silt:	20% to 30%	(0.002mm to 0.05mm)
Clay:	15% to 25%	(less than 0.002 mm)

b. Organic content of Planting Soil Mix shall have a range of 2% to 10% by weight as determined by the appropriate testing method listed herein. Adjust organic content of Planting Mix prior to placing the soil and finished grading.
c. The pH of the Planting Soil Mix shall have a range of 6.0 to 7.0. Extremes shall be avoided.
d. The Planting Soil Mix shall also be amended with fertilizer and lime as recommended by the Soil Test Report and to meet requirements.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 85 percent calcium and magnesium carbonates.

1. Form: Provide lime in form of pelletized limestone.
2. Rate: Apply at a rate as recommended in the Soil Test Reports. Apply mechanically at least two weeks prior to planting and fertilizer applications. Incorporate into full depth of planting soil prior to finished grading.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: A commercially manufactured humus product that is dark, crumbly, fine textured, fully composted decayed organic matter specifically manufactured for use as a soil amendment to promote vegetative growth. Organic amendments shall be well-aged, and contain no visible admixture or refuse or other physical contaminants nor any material toxic to plant growth.

1. Feedstock: Limited to leaves.

2. Reaction: pH of the finished composted organic matter near 7.0, within the range of 6.0 to 8.0.
3. Soluble-Salt Concentration: Less than 4 dS/m.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 40% minimum on a dry weight basis as determined by loss on ignition.
6. Particle Size: 100 percent passing through a ½"-inch screen.
7. Carbon/Nitrogen Ratio: between 12:1 and 25:1.
8. Degree of maturity: Composted organic matter shall be considered stable as determined by the Solvita compost maturity index. Compost must achieve a maturity index of 6 or better, indicating a curing active compost.
9. Ammonium content: Ammonium shall be less than 400 ppm on a dry-weight basis.

2.4 FERTILIZERS

A. Commercial Fertilizer: Complete slow-release commercial-grade complete fertilizer of neutral character, 50 percent of the fertilizer components shall be derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

2.5 GEOTEXTILE FABRIC

A. Geotextile shall consist of needled, non-woven polypropylene fibers and meet the following properties:

1. Grab tensile strength (ASTM D4632) ≥ 120 lbs.
2. Mullen burst strength (ASTM D3786) ≥225 psi.
3. Flow rate (ASTM D4491) ≥ 95 gal/min/ft2.
4. UV Resistance after 500 hours (ASTM D4355) ≥ 70%.
5. Heat-set or heat calendared fabrics are not permitted.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. 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 planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. If on-site topsoil is to be stockpiled and reused, excavate soil from designated areas and stockpile until amended. Depth of topsoil may vary, generally between 4” and 6”. Contractor shall make adjustments to excavation depths as necessary to avoid mixing subsoil with topsoil.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

3.3 PLACING BLENDED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Generally, Planting Soil Mix and Bio-Retention Soil mix is to be mixed before placement in its final location. For large lawn areas, Planting Soil may be mixed in place, with approval of the Engineer or Landscape Architect. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Application:

1. FOR LAWN AREAS:

    a. Till subgrade to a minimum depth of 8 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
    b. Apply approximately two inches of the Planting Soil Mix over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade.
    c. Spread remaining Planting Soil Mix to meet depths as indicated on plan (4” minimum), and as required to meet finished grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet. Compact each lift of to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.
    d. Finish grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
    e. Test for compaction before installing seed or sod.
    f. Install seed mix or sod in accordance with the applicable specification section.

2. FOR LANDSCAPED AREAS, planting beds, and tree and shrub pits:

    a. Till subgrade to a minimum depth of 8 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
    b. Apply approximately two inches of the Planting Soil Mix over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade.

c. Spread Planting Soil Mix in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Compact each lift soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698. Continue until planting bed or tree pit excavation is filled to finished grade.
d. Finish grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
e. Text for compaction before installing plant material.
f. Install plant material in accordance with the applicable specification section.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor to engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests:

1. Compaction: Test Planting Soil Mix compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.
2. Filtration: Perform infiltration testing on the Bio-Retention Soil Mix after placement. If the tested infiltration rate is determined to be out of the allowable range of 0.5 to 1.0 inches per hour, additional soil amendments will be required.

C. Soil will be considered defective if it does not pass tests.

D. Submit test reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.5 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.

6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Engineer or Landscape Architect and replace contaminated planting soil with new planting soil.

3.6 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 91 13

SECTION 32 92 00 - TURF AND GRASSES

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. Seeding.
2. Hydroseeding.
3. Sodding.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

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

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: April 15th through May 31st.
2. Fall Planting: August 17th through October 15th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: Seed of grass species as listed below, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
2. Seed mix as indicated on drawings.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.

2.3 FERTILIZERS

A. 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: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

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

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.5 PESTICIDES AND HERBICIDES

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

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

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. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is 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, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation”.

B. Placing Planting Soil: Place planting soil over exposed subgrade. Smooth the surface with a wide landscaping rake.

C. Add soil amendments to the soil according to the recommendations supplied in the Soil Test Report. Apply the amendments in two directions to ensure even coverage of spreadable amendments. Till into the soil to a depth of at least 6 inches.

D. Resmooth the surface with a wide landscaping rake. Remove any stones or vegetative matter that has risen to the surface during tilling and raking.

E. Roll the area with a lawn roller to create a firm work surface. Roll until an average person can walk on the compacted soil and leave footprints that are ½” deep.

F. Water the surface to check for puddles. When soil is dry enough to work, regrade the surface to eliminate puddles and provide positive drainage, as indicated on the construction plans.

G. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

H. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 3:1 with an organic soil stabilizer installed according to manufacturer's written instructions.

E. Protect seeded areas by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow grass to a height of 2 1/2 to 3 inches or less.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

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

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 32 93 00 - PLANTS

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. Trees.
2. Shrubs
3. Groundcover.
4. Perennials.
5. Mulches.
6. Landscape edging.
7. Tree stabilization.
8. Related materials.

B. Related Requirements:
1. Section 329113 “Soil Preparation” for planting soil mixes.
2. Section 329200 "Turf and Grasses" for turf (lawn) seeding and sodding.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

G. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

H. Planting Area: Areas to be planted.

I. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.

J. 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.

K. 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.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

M. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Anti-desiccant spray
2. Mycorrhizal inoculant.
3. Pesticides and herbicides
4. Steel edge and stakes.

5. Tree stabilization.

B. Samples for Verification: For each of the following:

1. Organic Mulch: 1-quart 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.

2. Edging Materials and Accessories: 6” sample section.

3. Tree Stabilization: 1 piece or unit.

C. Plant Material:

1. Location Data: Quantities and sizes of each plant material type, location of nursery, and location of growth (if different from nursery). Include address, phone number, and contact person for each nursery or other place of growth.

2. Photographs: At least 14 days prior to submittal of Plant Material Location Data, submit three color photographs in digital format of each required species and size of plant material as it will be furnished to the Project.

a. 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.

b. 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.

c. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For 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. 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. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. 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 above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

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 compliance 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 materials 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 or the container. Do not lift or handle container plants by the tops, stems, or trunks. Do not bend or bind/tie trees or shrubs in such a manner as to destroy their natural shape. Do not drop plants during delivery or handling.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply antidesiccant to trees and shrubs 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.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation. Pad trunk and branches at all points of contact between plant material and equipment.

H. 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. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.10 FIELD 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. 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: March 15th through May 15th.
2. Fall Planting: October 15th through November 30th.

C. 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.

1.11 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.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.

2. Warranty Periods: From date of Substantial Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
c. Delays in completion of planting operations which extend the planting into more than one planting season shall extend the Warranty Period accordingly.

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 is 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.

4. Incorrect Materials:

a. During Warranty Period, replace at no cost to the Owner, plants revealed as being untrue to name.
b. Provide replacements of a size and quality to match the planted materials at the time the mistake is discovered.

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 List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning.

1. 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.

2. Provide plants with healthy, well developed root systems, free of kinked, circling, girdling and center roots, root-bound conditions, and cracked or broken root balls.

3. Trunk and branches must be structurally strong and tree must be able to stand upright without stakes or guys on a windless day. Reject trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); with crossing trunks; or with cut-off limbs more than 3/4 inch in diameter.

4. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

5. Climatic Growing Conditions: Plant material shall be grown under climatic conditions similar to those of the project for at least two years unless otherwise accepted by the Landscape Architect.

6. Container Growth Limitations: Container stock, excluding annuals, shall have been grown in the containers in which plant material is delivered for at least six months, but not more than two years.

7. Do not prune, thin, or shape plants before delivery without approval of the Landscape Architect.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or

cultivar, if applicable for the plant. Plant nomenclature shall meet requirements o ICBN and ICNCP.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

2.3 MULCHES

A. Organic Mulch: Free of soil, rocks, toxic material, weed seeds, and other deleterious materials, and suitable as a top dressing of trees, shrubs, and plants. Mulch shall be of a uniform grade with no additives or any other treatment. The pH shall range from 5.8 to 6.2.

1. Shredded hardwood mulch.
   a. Aged, double shredded.
   b. Color: Natural.

2. Composted Leaf Mulch

2.4 PESTICIDES AND HERBICIDES

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

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 LANDSCAPE EDGING

1. (Base Bid) Aluminum Edging for River Stone: Extra Heavy Duty Straight Profile Edging: Permaloc Cleanline XL, 3/16” inch x 6” high, extruded aluminum, 6063 alloy, T-6 hardness, landscape edging for straight-line and curvilinear applications.

2. (Add Alternate) Aluminum Edging for Landscape Beds: Heavy Duty Straight Profile Edging: Permaloc Cleanline, 3/16" inch x 4" high, extruded aluminum, 6063 alloy, T-6 hardness, landscape edging for straight-line and curvilinear applications.
3. Thickness: 3/16" gage section at 0.116 inch minimum thickness with 0.375 inch exposed top lip.
4. Length: 8' or 16' long sections.
5. Connection Method: Section ends shall be spliced together with the sliding XLR Adaptor.
6. Stakes: 18" long Permaloc Heavy Duty Stake, 0.125 inch thick, extruded aluminum.
7. Finish: Black DuraFlex Painted, complying with AAMA 2603 for electrostatically baked on paint.
8. Install per manufacturer's written installation instructions.
9. Manufacturer: Permaloc Corporation, 13505 Barry Street, Holland MI 49424.
   email: info@permaloc.com
   website: www.permaloc.com

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials (use only if required):

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or equivalent.
3. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

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. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.

3. Suspend planting 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 or which is dusty.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings.

1. Stake locations of trees where indicated on drawings. Drive a 3-foot long wood lath stake at each tree location and mark each tree type with a different color survey tape.

2. Lay out container grown shrubs and perennials as indicated on the drawings. Do not remove container grown shrubs from containers until time of planting.

3. Lay out a sample of ground cover spacing for review.

4. Contact the Landscape Architect to review locations prior to excavation of the plant pits. Adjust the locations in the field as directed by the Landscape Architect.

5. Do not excavate plant pits until the Landscape Architect has accepted the locations.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation".

B. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. 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.
2. Excavate plant pits to a diameter which is three times as wide as root ball diameter for trees and shrubs.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected after working hours and when unattended by Installer's personnel.

B. Backfill Soil: Planting Soil Mix as specified in Section 329113 “Soil Preparation”.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of 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. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting Soil mix as specified.
2. 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. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Fertilization as recommended by soil testing reports.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Balled and Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting Soil mix as specified.
2. Carefully remove root ball from container without damaging root ball or plant.
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. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Fertilization as recommended by soil testing reports.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE-SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.

C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

D. Cut exposed roots cleanly during transplanting operations.

E. Plant trees following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

3.7 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 as directed by Landscape Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices, in accordance with the ANSI A300 Part I (Pruning) Standards from the Tree Care Industry Association. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.8 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees over 2” caliper. Stake trees of less than 2-inch caliper as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3. Do not install root barrier surrounding the root ball of tree.

3.9 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Backfill: Planting Soil mix as specified.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.11 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

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 integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.12 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.13 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations at no cost to the Owner, in a manner approved by Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern, at no cost to the Owner.

1. Provide new trees of same size as those being replaced.
2. Species of Replacement Trees: Same species being replaced.

C. Plant Warranty will apply to replaced plant materials.

3.14 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

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

C. 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.

D. 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.

END OF SECTION 32 93 00

SECTION 33 05 00 COMMON WORK RESULTS FOR UTILITIES

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. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Grout.
4. Piping system common requirements.
5. Equipment installation common requirements.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

B. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

2. Install connections to existing utilities, per the utility companies requirements and specifications.

3.4 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.5 GROUTING

A. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout.

C. Avoid air entrapment during placement of grout.

D. Cure placed grout.

END OF SECTION

SECTION 33 41 00 – SITE STORM SEWERAGE SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Storm sewerage systems shall include but not be limited to:

1. Storm water system for the project site.
2. Storm pipes.
3. Storm structures.
4. All excavating and backfill required for the storm sewer system.

1.2 REFERENCE STANDARDS

A. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of storm water systems materials and products.

B. Comply with applicable portions of Philadelphia Water Department (PWD) regulations pertaining to storm sewage systems.

C. Comply with applicable Pennsylvania Department of Transportation (PennDOT), Publication 408, "Specifications", latest revision.

D. American Society for Testing and Materials (ASTM):

1. A 36 Structural Steel.
2. A 185 Welded Steel Wire Fabric for Concrete Reinforcement.
3. ASTM F-2648 – Corrugated Drainage Pipe

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for storm sewer system materials and products.

B. Shop Drawings: Submit shop drawings for storm sewer systems, showing piping materials, size, locations, and inverts. Include details of underground structures, connections, screens, traps, weir plate, valves and manholes, Show interface and spatial relationship between piping and structures.

C. Record Drawings: At project closeout, submit record drawings of installed storm water piping and products.

1.4 QUALITY ASSURANCE

A. The services of qualified inspection and testing agencies shall be used for this work.

B. Manufacturer's Qualifications: Obtain materials from firm's regularly engaged in manufacture of storm sewer system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

C. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with storm water work similar to that required for project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle pre-cast concrete manholes and other structures according to manufacturer's written rigging instructions.

PART 2 – PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mills thick. Provide green tape with black printing reading "CAUTION STORM LINE BURIED BELOW".

2.2 PIPES AND PIPE FITTINGS

A. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same materials and weight/class as pipes, with joining method as indicated.

1. Ductile-Iron Sewer Pipe: ASTM A 746, for push-on joints.

    a. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
    b. Gaskets: AWWA C111, rubber.

2. Refer to 321806 for field drainage materials.

2.3 DRAINAGE STRUCTURES AND APPURTENANCES

A. Reinforcing Mesh and Bars: Welded plain cold drawn steel wire fabric, ASTM A185. Deformed steel bars, grade 60, ASTM A615.

B. Inlet Sub-base: Soil material in accordance with PennDOT Specifications Section 350.2.

C. Coarse Aggregate: PennDOT Type C or better in accordance with PennDOT Specification Section 703.2. Provide aggregate sizes as shown on the drawings.

D. Concrete: All concrete shall be in accordance with PennDOT Specifications Section 704 Class A concrete.

E. Storm Sewer Manholes, Catch Basins and inlets: All materials to be in accordance with the details shown on the drawings, Philadelphia Water Department Specifications or PennDOT Specification Sections 605 and 713.2 except catch basin and inlet grates and frames shall only be acceptable in structural steel conforming to AASHTO M183 or ASTM A36, the more stringent requirements apply.

F. Ductile Iron grate: Provide in accordance with ASTM A536 class 65-45-12.

1. Urban Accessories – Trench Drain Grate: 4.9” x 500 mm Double Wave Grate for ACO Klassik Drain to be used for proposed trench drain within plaza.

a. Material: Ductile iron.
b. Finish: Black, manufacturer’s standard powdercoat; matte.

G. Geo-textile Fabric: Linq Industrial Fabrics, Inc., Style 125EX, non-woven polypropylene fabric; or approved equal.

PART 3 – EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earthwork."

3.2 INSTALLATION OF IDENTIFICATION

A. General: During backfilling/top-soiling of storm water systems, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade.

3.3 INSTALLATION OF PIPE AND PIPE FITTINGS

A. General: Install piping in accordance with governing authorities having jurisdiction, as well as pipe manufacturer, except where more stringent requirements are indicated.

B. Inspect piping before installation to detect apparent defects. Mark defective materials with paint and promptly remove from site.

C. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.

D. Place bell ends or groove ends of piping facing upstream.

E. Install gaskets in accordance with manufacturer's recommendation for lubricants, cements, and other special installation requirements.

F. Cleaning Piping: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
3. Flush lines between manholes if required to remove collected debris.

G. Joint Adaptors: Make joints between different types of pipe with standard manufactured adapters and fittings intended for the purposes.

H. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2' of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and re-inspect.

I. Construct all storm sewer pipes in accordance with PennDOT specification section 601.3 and Philadelphia Water Department (PWD) Standards, the more stringent apply, except trench backfill shall be in accordance with Section 312000 “Earthwork.”

3.4 STORM SEWER MANHOLES, INLETS AND CATCH BASINS

A. Construct storm sewer structures in accordance with PennDOT specification section 605.3 and ASTM C891 except backfill shall be in accordance with Section 312000 “Earthwork” and the details shown on the drawings

3.5 STORMWATER SYSTEM STRUCTURES

A. All construction shall conform to PennDOT Specifications Section 605.

END OF SECTION 33 41 00

SECTION 33 41 01 – CONNECTION TO EXISTING CITY OF PHILADELPHIA SEWER STRUCTURES

PART 1 - GENERAL

1.1 REFERENCES

A. ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-in. or 50 mm cube specimens).

B. ASTM D 638, Test Method for Tensile Properties of Plastics.

C. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.

1.2 SUBMITTALS

A. Before starting this work, submit for approval of City of Philadelphia Engineer and the Construction Manager, manufacturer's literature describing Epoxy Mortar Gel and Epoxy Bonding Agent. Literature must address each requirement (e.g., Compressive Strength per ASTM D 109).

1.3 SCOPE OF WORK

A. This work consists of making necessary adjustments and proper connections between new sewer structures and existing sewer structures and shall include sealing all remaining openings and all appurtenant work and materials necessary for completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following products are acceptable as Epoxy Mortar Gel, provided they continue to meet all requirements:

1. Meta Bond HM Gel, as manufactured by American Meta Seal Company, 509 Washington Avenue, Carlstadt, NJ 07072.
2. Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation, Box 297, Lyndhurst, NJ 07071.
3. Thermal-Chem Mortar Resin Gel (Product No. 304), as manufactured by Therma-Chem. Inc., 1400 Louis Avenue, Elkgrove, IL 60007.

B. The following products are acceptable as Epoxy Bonding Agent, provided they continue to meet all requirements:

1. Meta Bond HM, or Meta Bond HM Gel, as manufactured by American Meta Seal Company, 509 Washington Avenue, Carlstadt, NJ 07072.
2. Sikastix 370, Sikadur Hi-Mod, or Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation, Box 297, Lyndhurst, NJ 07071.
3. Thermal-Chem Mortar Resin (Product No. 3), or Therma-Chem Mortar Resin Gel (Product No. 304), as manufactured by Therma-Chem, Inc., 1400 Louis Avenue, Elkgrove, IL 60007.

2.2 MATERIAL

A. Epoxy Mortar Gel shall:

1. Be a 100% solids formulation.
2. Have a tensile strength per ASTM D 638 not less than 3000 psi after 7 days at 73°F.
3. Have a tensile elongation per ASTM D 638 not over 7%.
4. Have a compressive strength per ASTM D 695 not less than 3000 psi after 24 hours at 73°F, and not less than 6000 psi after 7 days at 73°F.

B. Sand Shall:

1. Be oven-dry silica sand.
2. Have at least 70% by weight pass #20 sieve.
3. Have not over 35% by weight pass #40 sieve.

C. Epoxy Bonding Agent shall meet the requirements for Epoxy Mortar Gel.

2.3 MIXES

A. Epoxy Mortar shall consist of Epoxy Mortar Gel and Sand mixed at a 1:1 ratio by loose volume.

PART 3 - EXECUTION

A. Make hole(s) in existing structure as necessary to permit connections. Drill ¾" to 1" diameter holes along perimeter of required opening. Break out existing material as necessary. Cut reinforcing as necessary. Remove all dirt, laitance, and other loose or undesirable material from mating surfaces. Check hole(s) for fit.

B. Comply fully with manufacturer's instructions. Coat mating surfaces with Epoxy Bonding Agent and set pipe. Seal all openings with Epoxy Mortar. Support pipe securely to prevent movement and protect for at least 24 hours.

END OF SECTION 33 41 01

PRECAST CONCRETE BUILDING
EASI-SET™ PREFABRICATED

Part 1 – GENERAL

1.01 SUMMARY

Contractor to furnish transportable precast concrete building components. Building to be delivered and placed on Owner's prepared foundation in accordance with Manufacturer's recommendations. Precast building to be EASI-SET™ Model 1214 as manufactured by M&W PRECAST LLC – Ottsville, PA (610-847-1423). Building is to be provided by Manufacturer with all necessary openings as specified by Contractor in conformance with Manufacturer's structural requirements.

1.02 REFERENCES

A. American Society for Testing and Materials
   1. ASTM A185; Standard Specification for Steel Welded Wire Reinforcement, Plain for Concrete
   2. ASTM A615; Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

B. American National Standards Institute (ANSI):
   1. ANSI A115.1; Preparation for Mortise Locks for 1-3/4" Doors
   2. ANSI A156.1; Butts and Hinges
   3. ANSIA156.13; Mortise Locks and Latches Series 1000

C. BOCA, Building Officials& Code Administrators International, Inc.

D. ACI-318-02, "Building Code Requirements for Reinforced Concrete".

E. Concrete Reinforcing Institute, "Manual of Standard Practice".

F. ANSI/ASCE-7-2 "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures".

G. International Building Code (IBC) - 2015

H. UL-752 test method level 4 for bullet resistance certified by an independent structural engineer.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Provide a building designed in accordance with ACI-318 and local prevailing building codes for reinforced concrete and manufactured under Prestressed Concrete Institute (PCI) standards and Quality Control Manual MNL-116.

B. Dimensions:
   1. Exterior: 14'-0" x 20'-0" x 11'-3" high
   2. Interior: 13'-8" x 19'-4" x 8'-0" minimum ceiling height

C. Design Loads:
   1. Seismic Load Performance Category 'C', Exposure Group III
   2. Standard Live Roof Load – 60 psf
   3. Standard Floor Load – 250 psf
   4. Standard Wind Loading – 130 mph

D. Gabled Concrete Roof: Roof panels shall slope from approximately 33" above center of long-sided direction toward left and right long-sided walls. Exterior surface to be cast with smooth steel trowel finish. The roof shall extend a minimum of 2-½" beyond the vertical wall panel on each side and have a turndown design which extends ½" below the top edge of the wall panels to prevent water migration into the building along the top of wall panels. Roof shall also have a smooth edge.

E. Roof, floor and walls panels must each be produced as single component monolithic panels. No roof, floor or vertical wall joints will be allowed, except at corners. Wall panels shall set on top of floor panel.

F. Floor panel must have ½" step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

1.04 QUALITY ASSURANCE

A. Manufacturer must be producer member of the National Precast Concrete Association (NPCA) and participate in its Plant Certification Program.

B. Manufacturer Qualifications: A manufacturer who has experience in the fabrication of pre-engineered manufactured buildings for a period of 5 years minimum.

C. No alternate building designs to the pre-engineered EASI-SET building will be allowed unless pre-approved by the owner ten (10) days prior to bid date.

1.05 SUBMITTALS

A. Building engineering calculations that are designed and sealed by a State licensed Professional Engineer in which the building will be installed, shall be submitted for approval.

Part 2 – PRODUCTS

2.01 MATERIALS

A. Concrete: Steel-reinforced, 5000 psi minimum 28-day compressive strength, air-entrained (ASTM-C260)

B. Reinforcing Steel: ASTM A615, grade 60 unless otherwise indicated.

C. Post-tensioning Strand: 41K Polystrand CP50, .50, 270ksi, 7-wire strand, enclosed within a greased plastic sheath, (ASTM A416). Roof and floor each to be post-tensioned by a single, continuous tendon. Said tendon shall form a substantially rectangular configuration having gently curving corners wherein the positioning of the cable member results in a pattern of one or more loops and a bisecting of the loop(s). The cable member starts from one corner of the concrete building panel, forms a gentle perimeter loop(s) returning to a point where the cable member entered the concrete building panel. The tendon then turns 90 degrees and follows the cable member(s) to a point midway along the "Y" axis of the concrete building panel and then turns 90 degrees along the "X" axis of the concrete building panel. This bisects the concrete building panel and crosses the opposite parallel portion of the cable member and exits from an adjacent side of the concrete building panel.

    1. If post-tensioning is not used in the roof panel, the following guidelines must be followed to ensure a watertight roof design.

        a. The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.

        b. The entire precast concrete roof panel surface shall be sealed with a .045 EPDM continuous membrane cemented to the concrete with a compound designed for this purpose.

D. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant for exterior joints. SIKAFLEX-15LM elastic sealant for interior joints.

E. Panel Connections: All panels shall be securely fastened together with 3/8" thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A283, Grade C and powder coated after fabrication. All fasteners to be ½" diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be Meadow-Burke #FX-19, or equal. All inserts for corner connections must be fastened directly to form before casting panels. No-floating-in of connection inserts shall be allowed.

2.02 ACCESSORIES

A. Doors and Frames: Shall comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100) and as herein specified. The building shall be equipped with one (1) double set 3'-0" x 7'-0" x 1 ¾", 18 gauge galvanized active metal doors with 16 gauge galvanized frame. Doors and frame shall be

bonderized and painted one coat of rust inhibitive primer and one finish coat of enamel paint, Owner to select standard available color.

B. Door Hardware:

1. Hinges: McKinney TA2314 4-1/2" x 4-1/2" NRP (non-removable pin) x 32D, 3 per door, or equal
2. Lock Set: Schlage B660P6 x 12-296 x 10-087 x 626 Heavy Duty Commercial Grade Cylinder Deadbolt, or equal
3. Pull Plate: Rockwood 107 x 70C x Type 1 x US32D, or equal
4. Push Plate: Rockwood 70C-RKW x US32D, or equal
5. Door Holder: Rixson 9-326 x 630, or equal (inactive door)
6. Door Closer: Norton 8501 x 689, or equal (Restrooms)
7. Threshold: Pemko 171A x 72"w x A, or equal
8. Drip Cap: Pemko 346C x 76"w x C, or equal
9. Door Sweep: Pemko 315CN x 36"w x C, or equal
10. Surface Bolts: Rockwood 580-8 x US26D, or equal
11. Astragal: Pemko 357C84 x C, or equal

2.03 PLUMBING

A. The following fixture shall be wall mounted with piping through the wall into the building interior. A penetration will be provided in the building floor for entrance of plumbing utilities. The fixtures shall be as follows:

1 – Woodford B26-1/2- RB Mild Climate recessed hose bib with locking cover, or equal

2.04 ELECTRICAL

A. All equipment and conduit shall be surfaced mounted. The load center will be located in an area designated by Owner. All branch conduit and wiring shall be run to the load center. The connection of electrical utilities to the load center is by others. A penetration will be provided for entrance of electrical utilities into the building interior. The electrical components shall be as follows:

1 – Square-D Q0140M100 load center single phase, 100-amp, 120/240 volt, or equal

4 – Columbia Lighting LAW4-40ML-EDU 4' non-vandal resistant light fixture, or equal

4 – Raab Lighting Slim 12/PC Exterior light with photocell, or equal

1 – Leviton 1221-21 Single Pole Switch, or equal

3 – Leviton GFNT2-I 15-amp GFCI Receptacle, or equal

2.05 FINISHES

A. Interior of Building: Smooth steel trowel finish on all interior panel surfaces. The interior surfaces shall remain natural color concrete.

B. Exterior of Building: Smooth steel form finish on all exterior panel surfaces. The exterior surfaces shall remain natural color concrete.

C. Floor finish: Smooth steel form finish. The surface shall remain natural color concrete.

Part 3 – EXECUTION

3.01 SITE PREPARATION (Standard Preassembled Building)

A. Foundation shall be designed in accordance with local building code and soil conditions. The building shall bear fully on firm undisturbed soils with an approved fill or pad. The EASI-SET™ Building shall at a minimum bear fully on a crushed stone base that is at least two feet larger than the length and width of building

B. Stone shall be a minimum of 8" thick down to firm subgrade. The vertical soil capacity under stone shall be compacted to have minimum bearing of 1,500 pounds per square foot. Stone shall be ¾" clean or smaller, and topped with 2" of sand or screenings; and must be screed level within ¼" in both directions. Stone shall be placed within a perimeter form with flat and level top edge for screeding. Forming material shall remain around stone until after the building is set.

C. The crushed stone base shall be kept within the confines of the soil or perimeter form. Do not allow the base to become unconfined so that it may wash, erode or otherwise be undermined.

D. Or if the building is placed on pavement or a concrete slab, substrate below pavement or slab must have a vertical soil capacity of 1,500 pounds per square foot. Place stone or sand to 1" above highest point of area where building will be placed and at least 1'-0" wide all-around building footprint. Retain stone or sand with a perimeter form to prevent the material from washing out.

E. No building shall bear directly on rock. Where rock is closer than 2 feet from the bottom of the building floor slab or foundation slab, it shall be undercut to a minimum of 2 feet below the building and replaced with approved fill material.

F. Provide positive drainage for the fill, pad, or slab as required.

G. A vapor barrier of 6 mil polyethylene shall be placed between the fill, pad, or foundation slab, and the floor slab where moist conditions exist.

3.02 ACCESS

A. Contractor to provide level unobstructed area large enough for crane and tractor-trailer to park adjacent to pad. Crane must be able to place outriggers within 3'-0" of edge of pad and truck and crane must be able to get side-by-side under their own power. No overhead lines may be within 75' radius of center of pad. Firm roadbed with turns that allow 65' low-bed tractor and trailer access must be provided directly to site. No building shall be placed closer than 2"-0" to an existing structure.