

SUMMIT CAMPUS NEW MIDDLE SCHOOL AND HIGH SCHOOL

**Summit Bridge Road
Middletown, DE 19709**

**BID PAC 1
ISSUED FOR BID**



**Volume 2 [Divisions 02-34]
Date: June 25, 2025**

SECTION 00 01 07
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SECTION 03 30 10
MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 00 00 – GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 WORK INCLUDED

- A. Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. Cast-in-place concrete foundations (grandstand and press box).
 - 2. Cast-in-place concrete turf anchor.
 - 3. Foundations for ball netting foundations, goal posts, scoreboards.
 - 4. Chain link fence post footings.
 - 5. Other cast-in-place cement concrete site requirements as detailed in the Drawings.

1.03 RELATED WORK UNDER OTHER SECTIONS

- A. Athletic Ball Netting System
- B. Athletic Equipment
- C. Outdoor Scoreboards
- D. Grandstand and Press Box
- E. Chain Link Fence and Gates
- F. Infilled Synthetic Turf System

1.04 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
 - 1. American Society for Testing and Materials (ASTM):

C 67	Brick and Structural Clay Tile
C 91	Masonry Cement
C 144	Aggregate for Masonry Mortar
C 150	Portland Cement

C 207	Hydrated Lime for Masonry Purposes
C 270	Mortar for Unit Masonry

1.05 SUBMITTALS

- A. Complete shop drawings for reinforcing steel for each site wall, stair and other cast-in-place, reinforced concrete site components shall be submitted.
 - 1. Include placing drawings that detail fabrication, bending, and placement. Indicate bar sizes, lengths, bar schedules, bent bar diagrams, splices, and reinforcement supports.
 - 2. Provide elevation views of each wall.
- B. Manufacturer’s Product Data shall be submitted for all proprietary products used in concrete work including, but not limited to, curing compounds, admixtures, and reinforcement accessories.
- C. Concrete Mix Design: Submit proposed design mix for the type and strength of concrete specified. Provide separate mix designs for any change in ingredients. Include the following items:
 - 1. Mix proportions for all ingredients of the mix. Designate within the submittal where each mix is proposed to be used. Proportions shall be established by one of the following methods in accordance with ACI 301.
 - a. Field experience.
 - b. Trial Batch.
 - c. Water/cement ratio specified herein.
 - 2. Cement type.
 - 3. Aggregate gradations taken within 3 months from the date of submission. Specify size of coarse aggregate in accordance with ASTM size numbers.
 - 4. Provide data for all proprietary items incorporated into the mix including, but not limited to admixtures.
 - 5. Compressive strength results from an independent testing laboratory for mixes designed in accordance with trial batch or field experience methods.
 - a. Trial batches shall be tested within 12 months of the date of submission.
 - b. Submit quantity of tests in accordance with ACI 301. Note that mix designs developed in accordance with the field experience method must include a minimum of 30 consecutive tests, with an allowance for 10 to 30 consecutive tests with a higher average strength required.
 - c. Slump and air content shall be consistent with specifications for this project within tolerances specified within ACI 301.

1.06 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 C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer shall be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: If the trial batch method is used to design concrete mixes, testing shall be performed by an independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 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.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Reference Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specification for Structural Concrete", Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
 3. ACI 318, "Building Code Requirements for Structural Concrete".
 4. ACI 347R "Guide to Formwork for Concrete".
 5. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

1.07 TESTING AND INSPECTION

- A. The Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections will include the following:
 1. Steel reinforcement placement
 2. Concrete placement, including conveying and depositing.
 3. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 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, 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 (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression test specimens: ASTM C 31/C 31M. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days two specimens at 28 days. Retain the fourth specimen for testing at 56 days in the event that the 28-day strength tests do not attain the specified strength.

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- a. 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.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
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 (3.4 MPa).
9. Test results shall be reported in writing to the 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 the 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 the 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 dos not comply with the Contract Documents.

1.08 STRUCTURAL DESIGN

- A. The Contractor shall provide structural designs stamped by a professional engineer licensed in the State of Delaware for the following:
 1. Football Goal Post Footings
 2. Batting Tunnel Post Footings
 3. Athletic Ball Netting Footings
 4. Grandstand and Press Box Foundations
 5. Backstop Tension Netting Systems & Footings
 6. Baseball and Softball Foul Pole Footings
- B. Contractor shall make no additional monetary claims for structural design fees. It is also assumed the Contractor will review items requiring a structural stamp with a professional engineer prior to bid to ensure the Contractor's bid reflects an appropriate structural design.
- C. The Owner reserves the right to have tests made of mortar materials and mortar, at his option, as the job progresses. A recognized Testing Laboratory, selected by the Landscape Architect/Civil Engineer, with all costs paid by the Owner, will perform tests. The Contractor shall agree to abide by the results of the tests; he shall make all adjustments and changes to mortar and materials to meet the specification requirements at no additional cost to the Owner.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured products in manufacturer's original, unopened, and undamaged containers with labels intact and legible.

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- B. Store and handle manufactured products to prevent damage and deterioration.
- C. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage

PART 2 – PRODUCTS

2.01 COMPACTED DENSE GRADED CRUSHED STONE BASE

- A. Compacted Dense Graded Crushed Stone shall be as specified under Section 31 00 00 – EARTHWORK.
- B. The Contractor shall submit to the Landscape Architect a sieve analysis by an independent recognized testing laboratory of the material he intends to utilize. No material shall be placed until approved by the Landscape Architect in writing.

2.02 CAST-IN-PLACE CONCRETE

- A. Ready mix concrete shall conform to ASTM C-94, the batch plant shall be certified in compliance with the National Ready Mix Concrete Association standards. Concrete shall have a minimum 28-day compressive strength of 4,000 psi. Prepare design mixture for concrete, proportioned on the basis of laboratory trial mixture, field test data, or default water-cement ratio given below, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 - 2. When acceptable data is not available for either field experience or trial batch design methods, design mixture based on a maximum water/cement ratio of 0.35.
 - 3. Provide a maximum slump of 4 inches except for concrete containing a high-range water reducer. Concrete containing a high-range water reducer shall have a maximum slump of 8 inches when added to concrete with a maximum slump of 4 inches.
- B. Forms shall be steel or wooden forms at the Contractor's option and as approved by the Landscape Architect. Provide forms capable of producing uniform, straight, or curved concrete surfaces. Use only non-staining form release compounds.
- C. Reinforcing bars shall be deformed steel bars complying with ASTM A-615, grade 60. Provide miscellaneous bar supports and 18 gauge ASTM A-82 annealed steel wire ties.
- D. Portland cement shall conform to ASTM C-150, Type I or Type II. Use only one brand of cement throughout the project. Limit the temperature of the cement to 140 degrees Fahrenheit when delivered to the batching plant.
- E. Supplementary Cementitious Materials: The following cementitious materials may be substituted for a portion of the Portland cement in the design mixture. Limit the percentage, by weight, of cementitious materials as follows:
 - 1. Fly Ash: ASTM C 618, Class C or F. Maximum percentage = 25%.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120. Maximum percentage = 50%.
- F. Aggregates shall conform to ASTM C 33, Class 3S coarse aggregate. Provide aggregates from a single source with a long history of successful use in similar work and conditions.

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1. Maximum coarse aggregate size: Comply with size limits in ACI 301.
2. Fine aggregate: Free of materials with deleterious reactivity to alkali in cement.
- G. Water: ASTM C 94/C 94M, potable, and clean, potable and free of all impurities that are detrimental to concrete.
- H. Air-entraining admixtures shall conform to ASTM C-260; use only admixtures that have been accepted in the mix design. Provide admixture in such quantity to provide the following air entrainment within a tolerance of plus or minus 1.5 percent.
 1. 1-1/2 inch maximum aggregate size: 5.5 percent.
 2. 1 inch maximum aggregate size: 6.0 percent.
 3. 3/4 inch maximum aggregate size: 6.0 percent.
- I. Water reducing admixtures shall conform to ASTM C-494 Type A or F; use only admixtures that have been accepted in the mix design.
- J. Curing/sealing compound shall comply with FS TT-C-800, having at least 30% solids content.
- K. Miscellaneous curing materials:
 1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
 2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- L. Form Ties: Factory-fabricated, removable or snap-off metal or fiberglass reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 1/2" to the plane of the exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in the concrete surface and will permit neat and solid patching at every hole.
- M. Miscellaneous ties, if required, shall be hot-dipped galvanized steel straps, bars, rods and similar items which are fabricated from not less than 16 gauge sheet steel or 3/16" diameter steel wire. For precast and stone work, provide stainless steel slot anchors, threaded rods and other anchors as approved on shop drawings.
- N. Expansion Joint Filler:
 1. Fiber Type: Preformed asphalt impregnated fiber, ASTM D1751, 1/2 inch thick unless otherwise noted.
 2. Cork Type: Preformed cork expansion joint, ASTM D1752. Type II, 1/2 inch thick unless otherwise noted.
- O. Expansion joint Sealant: ASTM C920, Type M, Class 2 5; two part polyurethane traffic grade sealant, color to match concrete wall color and to be approved by the Landscape Architect. Vertical joints shall have Nonsag, Grade NS, Use NT sealant.

2.03 MORTAR

- A. Patching Mortar for exposed concrete shall be made of the same material and of approximately the same proportions as used for the site walls, except that coarse aggregate shall be omitted and mortar shall consist of not more than 1 part Portland cement to 2 1/2 parts damp loose sand by volume. Color to match concrete site walls.

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- 2.04 CAST-IN-PLACE CONCRETE SYNTHETIC TURF ANCHOR
- A. Concrete shall be 4,500 psi. Materials shall comply with paragraph 2.02 except as follows.
 - B. A slump pour for the turf anchor haunch is acceptable. This haunch is meant to prevent future settlement against the anchor and will not be visible.
 - C. Curing/sealing compound shall be equivalent to Day-Chem Sil-Cure J13.
 - D. Expansion materials:
 1. Expansion joints shall be located at the end of all curb runs and at a maximum of 60'.
 2. Expansion joint filler shall be preformed, non-bituminous type joint filler conforming to ASTM D 1752, Type II, similar to Sealtight Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., Elgin, IL 60120, or approved equal.
 3. Premolded filler shall be one piece for the full depth and width of the joint leaving a sealant recess as indicated and shall be an asphaltic material.
 4. Use of multiple pieces of lesser dimensions to make up required depth and width of joint will not be permitted.
 5. Except as otherwise noted on the Drawing, joint filler shall be ½" thick.
 6. Expansion joint shall receive joint backer rod and shall be sealed with approved joint sealer.
 7. Control joints shall be tooled in every 20'.
 - E. FIBROUS REINFORCEMENT
 1. All concrete at Infilled Synthetic Turf Anchors shall contain a fibrous reinforcement of 100% virgin polypropylene fibrillated fibers of multi-design gradation as manufactured by Fibermesh, Synthetic Industries, 4019 Industry Drive, Chattanooga, Tennessee 37416 or an equal product approved by the Landscape Architect.

PART 3 – EXECUTION

- 3.01 COMPACTED DENSE GRADED CRUSHED STONE BASE
- A. Refer to Section 31 00 00 – EARTHWORK for preparation of subgrade and dense graded crushed stone base.
 - B. The Contractor shall submit to the Landscape Architect a sieve analysis by an independent recognized testing laboratory of the material he intends to utilize. No material shall be placed until approved by the Landscape Architect in writing.
- 3.02 CAST-IN-PLACE CONCRETE
- A. Contractor shall excavate area to the lines and grades shown to provide proper footing for all concrete footings.
 - B. Contractor shall erect proper formwork to pour the concrete footings, and install reinforcing steel where required on Drawings. Formwork shall be free of defects and shall provide a smooth and even finish to the entire wall surface. Place concrete and finish as indicated on the Drawings and as specified. Contractor shall leave forms for a minimum of 48 hours.
 1. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
 2. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual.

- a. For concrete surfaces to be concealed, provide surface tolerance Class D, allowing surface irregularities of 1" when measured with a 5 foot straight-edge.
 - b. For concrete surfaces to be exposed to view, provide surface tolerance Class B, allowing irregularities of 1/4" when measured with a 5 foot straight-edge.
- C. Contractor shall protect the concrete against injury from the elements and defacement of any nature during construction.
- D. Strictly comply with industry standards and recommendations National Concrete Masonry Association except where more restrictive requirements are specified in this Section.
- E. Embedded Items: 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.

3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would 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.

3.04 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete. Width of keys shall be equal to 1/3 of the member thickness unless otherwise noted.
 - 3. Intentionally roughen the concrete surface of construction joints between footings and walls and elsewhere as indicated. Provide a minimum surface roughness amplitude of 1/4 inch.

3.05 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Maintain a minimum of 2 working vibrators on the jobsite during each concrete placement.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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 to not 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 (150 mm) 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. 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 (4.4 deg C) 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.
 4. Protection of Footings against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) 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.

3.06 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- C. 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 (300-mm) 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 (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than

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seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.07 CONCRETE SURFACE REPAIRS

- A. Repair surface imperfections by patching or grinding in accordance with ACI referenced standards. Allow 28 days after placement before performing surface repairs unless otherwise directed.
- B. At concealed surfaces, grind projections larger than 1". Patch voids larger than 1-1/2" wide or 1/2" deep. Finished surface shall comply with Surface Finish 1.0 per ACI 301.
- C. At surfaces that will be exposed to view, grind projections larger than 1/4". Patch voids larger than 3/4" or 1/2" deep. Patching material shall have color to match adjacent surfaces.
 1. Prepare a patching mock-up for approval before performing patching to surfaces that will be exposed to view. Patch an area that will be inconspicuous and allow for viewing by Activitas before proceeding with successive patching.

END OF SECTION

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SECTION 11 65 00
ATHLETIC BALL NETTING SYSTEMS**PART 1 - GENERAL**

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 00 00 – GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 WORK INCLUDED

- A. Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. 20' Protective Ball Netting System
 - 2. 10' Protective Ball Netting System
 - 3. Athletic Netting Post Padding (at Track & Field, only)
 - 4. Custom 30' High Pole-to-Pole Tension Backstop System
 - 5. Custom 40' High Pole-to-Pole Tension Backstop System

1.03 RELATED WORK UNDER OTHER SECTIONS

- A. Miscellaneous Cast-in-place Concrete
- B. Bituminous Concrete Pavement
- C. Infilled Synthetic Turf System
- D. Natural Grass Athletic Field System
- E. Resilient Track Surfacing
- F. Chain Link Fence and Gates

1.04 REFERENCES

- A. ASTM - American Society for Testing and Materials
- B. The State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.

1.05 LAWS, ORDINANCES, PERMITS AND FEE

- A. The Contractor shall:
 - 1. Give necessary notices, obtain all permits and pay all Governmental taxes, fees and other costs in connection with this work, file all necessary plans, prepare documents and obtain all necessary approvals of the local Building Departments having jurisdiction.

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2. Obtain all required certificates of inspection for this work and deliver same to the Field Consultant before request for acceptance and final payment for the work.
3. Include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to Contract Drawings and Documents) in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the Drawings and/or specified.

1.06 QUALITY ASSURANCE

- A. Source: For each type of product required for the work of this Section, provide products of one manufacturer and source for consistency.
- B. Codes and Standards: Perform site improvements work in compliance with applicable requirements of governing authorities having jurisdiction. Workmanship and finish shall be equal to the best practice of modern shops for each item of work.
- C. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- D. The work of this Section shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades which adjoin materials of this Section before installing items specified.

1.07 SUBMITTALS

- A. Shop Drawings: Supply shop drawings at an approved scale for location, installation and erection of all parts of the work under this Section including but not limited to the following:
 1. 20' Protective Ball Netting System
 2. 10' Protective Ball Netting System
 3. Athletic Netting Post Padding (at Track & Field, only)
 4. Custom 30' High Pole-to-Pole Tension Backstop System
 5. Custom 40' High Pole-to-Pole Tension Backstop System
- B. Product Information: Provide manufacturer's data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation. Work includes but is not limited to the following items:
 1. 20' Protective Ball Netting System
 2. 10' Protective Ball Netting System
 3. Athletic Netting Post Padding (at Track & Field, only)
 4. Custom 30' High Pole-to-Pole Tension Backstop System
 5. Custom 40' High Pole-to-Pole Tension Backstop System
- C. Material Selection and Samples: Submit samples showing the complete range of colors, textures and finishes available for all components required for construction. Work includes but is not limited to the following:
 1. Provide a 12" x 12" sample of each type of protective netting.
 2. Provide a 12" section of support tubing.
 3. Provide pipe sleeve sample.
 4. Provide samples of all connections.

5. Provide samples of a padding system and connections.

1.08 STRUCTURAL DESIGN, TESTING, AND INSPECTION

- A. The Contractor shall provide structural designs for all of the proposed footings that shall be stamped by a professional engineer licensed in the State of Delaware. Contractor shall make no additional monetary claims for structural design fees. It is also assumed the Contractor will review items requiring a structural stamp with a professional engineer prior to bid to ensure the Contractor's bid reflects an appropriate structural design.

PART 2 - PRODUCTS

2.01 CAST-IN-PLACE CONCRETE FOOTINGS

- A. Refer to Section 03 30 50 – Miscellaneous Cast-in-place Concrete.

2.02 20' ATHLETIC BALL NETTING SYSTEM

- A. 20' Athletic Ball Netting System shall be equivalent to Model BSS420 StormGuard® Professionally Pre-Engineered 20' High Straight Pole Break-Away Ball Safety Netting System and Accessories as manufactured by Sportsfield Specialties, 41155 State Highway 10, Delhi, NY 13753, (888) 975-3343 or approved equal.
 1. 3-1/2" Schedule 40 Aluminum Pipe (4" O.D.), 23'-6"L
 2. Upright post color to be custom powder coat as selected from the Manufacturer's Standard Colors. Color to be black.
 - a. One (1) Post at Multi-Purpose Field #2 shall be Powder Coated Yellow to act as a foul pole.
 3. 1 3/4" mesh netting and cables to be black.
 - a. Netting heights, lengths, and cutouts shall be verified in field prior to ordering.
 4. Ground Sleeve to be 30" length. Provide Ground Sleeve Caps for each Ground Sleeve.
 5. Provide Ground Sleeve Cap Removal Tool
 6. Provide Quick-Clips for Net Attachments and Net Guide Rings.

2.03 10' ATHLETIC BALL NETTING SYSTEM

- A. 10' Athletic Ball Netting System shall be equivalent to Model BSS210 10' Straight Pole Ball Safety Netting System and Accessories as manufactured by Sportsfield Specialties, 41155 State Highway 10, Delhi, NY 13753, (888) 975-3343 or approved equal.
 1. 2" Schedule 80 Aluminum Pipe (2.375" O.D.), 12'-8.25"L
 2. Upright post color to be custom powder coat as selected from the Manufacturer's Standard Colors. Color to be black.
 3. 1 3/4" mesh netting and cables to be black.
 - a. Netting heights, lengths, and cutouts shall be verified in field prior to ordering.
 4. Ground Sleeve to be 24" length. Provide Ground Sleeve Caps for each Ground Sleeve.
 5. Provide Ground Sleeve Cap Removal Tool
 6. Provide Quick-Clips for Net Attachments and Net Guide Rings.

2.04 ATHLETIC NETTING POST PADDING

- A. Padding shall be 6' high and 2" thick high impact foam, wrapped in 19 oz. heavy coated vinyl with 1 ½" wide sewn in hook and loop vertical closure, as manufactured by Sportsfield Specialties, 41155 State Highway 10, Delhi, NY 13753, (888) 975-3343 or approved equal.
- B. Colors shall be selected by the Owner from the manufacturer's standard list.
- C. Pads shall be fabricated to align with the outside diameters of the 20' ball netting systems and shall have an opening for the net post rope cleats.
- D. Refer to plans for quantity. One pad shall be furnished for each 20' ball netting post at the track and field only.

2.05 CUSTOM 30' HIGH POLE-TO-POLE TENSION BACKSTOP SYSTEM

- A. 30' High Pole-to-Pole Tension Ball Safety System shall be equivalent to Model TNPPUC Pole-to-Pole Tension Ball Safety Netting System with Ultra Cross Netting and Accessories as manufactured by Sportsfield Specialties, 41155 State Highway 10, Delhi, NY 13753, (888) 975-3343 or approved equal.
- B. Components
 - 1. Pole-to-Pole Tension Ball Safety Netting System Upright Support Posts and Pole Structures – Fabricated, Sized and Configured as Required:
 - a. Height Above Finish Grade as Required
 - b. Super Durable Powder Coated Black Finish with Enhance Resistance to UV and Fade
 - c. Ground Sleeve, Base Plate or Permanent Embedment Mount
 - d. Hot Dipped Galvanized Assembly Hardware - Quantities, Sizes and Configurations as Required
 - 2. Pole-to-Pole Tension Ball Safety Netting System Wire Rope Support Structure:
 - a. Length, Height and Configuration as Required
 - b. 7 x 19 GAC Galvanized Aircraft Cable - 5/16" Diameter Main Horizontal Support, 9,800 lb. Minimum Breaking Strength, 3,267 lb. Minimum Working Load Limit
 - c. 7 x 19 GAC Galvanized Aircraft Cable - 1/4" Diameter Vertical and Bottom Horizontal Supports, 7,000 lb. Minimum Breaking Strength, 2,333 lb. Minimum Working Load Limit
 - d. Hot Dipped Galvanized Attachment and Assembly Hardware - Quantities, Sizes and Configurations as Required
 - 3. Pole-to-Pole Tension Ball Safety Netting System Net and Rope Bound Border:
 - a. Length, Height and Configuration as Required
 - b. Ultra Cross Knotless Netting
 - c. Dyneema® Ultra-High Molecular Weight Polyethylene (UHMWPE) SK-75 Black Fiber Construction
 - d. 4 Ply, 1.2 mm (0.0472") Diameter Twine
 - e. 95% Open Mesh Area (See-Through Visibility)
 - f. 58,445 psi Minimum Breaking Strength
 - g. 30% Maximum Elongation at Break
 - h. 1-3/4" (44 mm) Square Mesh Size, 0.009 lbs. per Square Foot
 - i. 4-Strand, Braided, Continuous Monofilament Dyneema® Fiber

- j. Black Multi-Filament Polypropylene Solid Braid Derby Rope
Sewn Binding on Perimeter Edges - 1/4" Diameter, 530 lb.
Minimum Breaking Strength
- k. Urethane Black Bonded Finish
- l. Strong Resistance to Ultraviolet (UV) Light Degradation
- m. Excellent Resistance to Chemicals and Water Absorption

2.06 CUSTOM 40' HIGH POLE-TO-POLE TENSION BACKSTOP SYSTEM

- A. 40' High Pole-to-Pole Tension Ball Safety System shall be equivalent to Model TNPPUC Pole-to-Pole Tension Ball Safety Netting System with Ultra Cross Netting and Accessories as manufactured by Sportsfield Specialties, 41155 State Highway 10, Delhi, NY 13753, (888) 975-3343 or approved equal.
- B. Components
 - 1. Pole-to-Pole Tension Ball Safety Netting System Upright Support Posts and Pole Structures – Fabricated, Sized and Configured as Required:
 - a. Height Above Finish Grade as Required
 - b. Super Durable Powder Coated Black Finish with Enhance Resistance to UV and Fade
 - c. Ground Sleeve, Base Plate or Permanent Embedment Mount
 - d. Hot Dipped Galvanized Assembly Hardware - Quantities, Sizes and Configurations as Required
 - 2. Pole-to-Pole Tension Ball Safety Netting System Wire Rope Support Structure:
 - a. Length, Height and Configuration as Required
 - b. 7 x 19 GAC Galvanized Aircraft Cable - 5/16" Diameter Main Horizontal Support, 9,800 lb. Minimum Breaking Strength, 3,267 lb. Minimum Working Load Limit
 - c. 7 x 19 GAC Galvanized Aircraft Cable - 1/4" Diameter Vertical and Bottom Horizontal Supports, 7,000 lb. Minimum Breaking Strength, 2,333 lb. Minimum Working Load Limit
 - d. Hot Dipped Galvanized Attachment and Assembly Hardware - Quantities, Sizes and Configurations as Required
 - 3. Pole-to-Pole Tension Ball Safety Netting System Net and Rope Bound Border:
 - a. Length, Height and Configuration as Required
 - b. Ultra Cross Knotless Netting
 - c. Dyneema® Ultra-High Molecular Weight Polyethylene (UHMWPE) SK-75 Black Fiber Construction
 - d. 4 Ply, 1.2 mm (0.0472") Diameter Twine
 - e. 95% Open Mesh Area (See-Through Visibility)
 - f. 58,445 psi Minimum Breaking Strength
 - g. 30% Maximum Elongation at Break
 - h. 1-3/4" (44 mm) Square Mesh Size, 0.009 lbs. per Square Foot
 - i. 4-Strand, Braided, Continuous Monofilament Dyneema® Fiber
 - j. Black Multi-Filament Polypropylene Solid Braid Derby Rope
Sewn Binding on Perimeter Edges - 1/4" Diameter, 530 lb.
Minimum Breaking Strength
 - k. Urethane Black Bonded Finish
 - l. Strong Resistance to Ultraviolet (UV) Light Degradation
 - m. Excellent Resistance to Chemicals and Water Absorption

Summit Campus Middle and High School		Appoquinimink School District
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PART 3 - EXECUTION

- 3.01 PROTECTIVE BALL NETTING SYSTEMS
- A. Provide and install sleeves and posts plumb and true to grade in accordance with the Manufacturer’s recommendations and Approved Shop Drawings.
 - B. The posts shall be placed in alignment with the chain link fence at the bottom of the net. Refer to details for the layout of the netting poles and the chain link fence posts.
 - C. Install netting so that the bottom is bundled appropriately and attached to the top of the chain link fence so it is a clean connection between the two systems.

END OF SECTION 11 65 00

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DIVISION 26: ELECTRICAL

Section 26 00 00	General Provisions – Electrical
Section 26 01 10	Raceways
Section 26 01 20	Wires and Cables
Section 26 01 30	Manholes
Section 26 05 20	Roadway & Parking Area Lighting

SECTION 26 00 00

GENERAL PROVISIONS – ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide all materials, equipment, labor, services and all appurtenances required to completely install and satisfactorily operate the various systems. The items listed below are for general guidance only and do not necessarily include the entire requirements for the project.
 - 1. Coordination with other trades
 - 2. Electrical service
 - 3. Communications raceway system
 - 4. Related work as herein described or otherwise defined under the heading "Related Work".
- B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 RELATED WORK

- A. Equipment specified in sections of Divisions 1 thru 23 that require electric power supply.
- B. Work related to this trade as defined on the following contract drawings:

Architectural/Structural

Civil

1.4 SITE CONDITIONS

- A. Attention of all bidders is called to the necessity for a careful inspection of the site, its present condition and encumbrances, the extent of the work, the protection to be afforded to adjacent properties or structure, availability of utilities, the extent and nature of the material required to be excavated and the amount of fill and removal. He shall also determine local or site limitations which will affect construction.

1.5 PERMITS, INSPECTIONS AND ORDINANCES

- A. All work shall be executed and inspected in accordance with local and state ordinances, rules and regulations and the requirements of public utilities having jurisdiction. The contractor shall secure and pay for all permits, inspections and connections required.

- B. The Electrical Contractor shall furnish a certificate of inspection to the Owner at the time of completion.
 - C. Requirements of the following organization shall be considered minimum:
 - 1. National Electrical Code
 - 2. National Electrical Safety Code
 - 3. OSHA
 - 4. Local City and County Codes
 - D. Reference to technical societies, trade organizations and governmental agencies are in accordance with the following:
 - 1. ANSI - American National Standards Institute
 - 2. ASTM - American Society for Testing Materials
 - 3. IEEE - Institute of Electrical and Electronics Engineers, Inc.
 - 4. NEC - National Electrical Code
 - 5. NEMA - National Electrical Manufacturer's Association
 - 6. NFPA - National Fire Protection Association
 - 7. MSS - Manufacturer's Standardization Society
 - 8. IES - Illuminating Engineers Society
 - 9. ETL - Engineering Testing Laboratories
 - 10. EIA - Electronic Industries Association
 - 11. OSHA - Occupational Safety and Health Administration
 - 12. Federal Specifications
 - 13. UL - Underwriters Laboratories, Inc.
- 1.6 QUALITY ASSURANCE
- A. Provide adequate supervision of labor force to assure that all aspects of the contract documents are fulfilled.
- 1.7 COORDINATION
- A. As a requirement of this project, the Electrical Contractor shall furnish coordination for his equipment and layouts with other subcontractors furnishing equipment and services for Divisions 1 thru 23. Any and all contractors who install their equipment or furnish services prior to coordination,

any contractor who changes their equipment or services after coordination has occurred, without notifying associated subcontractors, shall be held responsible for making all required changes with no additional cost to the Owner. Or delay in construction time. This coordination will include conduit layout to allow access to equipment for maintenance.

- B. The drawings and specifications reflect the type, number and size of services required for the equipment the design is based upon. Should the supplying subcontractor elect to furnish an alternate piece of equipment requiring difference services and/or space conditions, he shall inform the subcontractor furnishing those services and be held responsible to pay for all required changes as part of this contract.

1.8 SUBMITTALS

A. Shop Drawings:

- 1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

- 2. Shop drawings comprising complete catalog cuts, performance test data for electrical equipment as required by other sections of Division 26 shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, wiring diagrams and similar materials, the Electrical Contractor represents that he and/or his subcontractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the Divisions 1 thru 23 subcontractors.
- 3. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto:
 - a. Project name
 - b. Project number
 - c. Sub-Contractor's, Vendor's and/or manufacturer's name and address.
 - d. Product identification.
 - e. Identification of deviation from the contract documents.
 - f. Applicable contract drawings and specification section number.
 - g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
 - h. Resubmit revised or additional shop drawings as requested.
 - i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the Contractor making the submission to identify by

name, the Contractor who is to do this work. If the Contractor named is other than the Contractor making the submission, the shop drawing submission must be reviewed by the named Contractor and bear his mark of approval, prior to submission to the Architect/Engineer.

- j. The Contractor shall keep a copy of approved shop drawings at the job site.
- k. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

1.9 SUBSTITUTIONS

- A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.
- B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.
- C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.
- D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.10 INTERPRETATION OF SYSTEMS

- A. The interpretation of the Architect will be final in the event there is a lack of understanding of the full scope or requirements of the systems under this contract.

PART 2 – PRODUCTS

2.1 MATERIAL

- A. All material shall be new and of good quality. Material shall conform to all accepted trade standards, codes, ordinances, regulations, or requirements governing same, and shall be approved before being installed.
- B. The Architect reserves the right to require the Contractors to submit samples of any or all articles or materials to be used on the project.
- C. Where any device or equipment is herein referred to in the singular number, such as "the panel", this reference shall be deemed to apply to as many such devices or equipment as are required to complete the installation as shown on the drawings or specified.

- D. All materials and equipment used in the work shall comply with the standards of recognized authorities such as UL, NEMA, IEEE, ETL, IES and EIA in every instance where such standards have been established for the particular type of materials to be installed.
 - E. All similar pieces of equipment or materials of the same type or classification used for the same purpose shall be of the same manufacturer.
 - F. All manufactured equipment shall have factory applied finishes.
- 2.2 CONCRETE
- A. Concrete shall be in accordance with Section 03300, or ACI-613.
 - B. The 28-day minimum compressive strength shall be 3000 psi.
- 2.3 WARRANTY
- A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Prior to performing the work, examine areas and conditions; check and verify all dimensions, under which the work is to be installed and notify the Architect in writing of conditions and dimensions detrimental to the proper and timely completion of the work. Do not proceed until authorization is given by the Architect.

3.2 LAYING OUT WORK

- A. The Contractor is responsible for the accuracy of all lines, elevations, and measurements, grading and utilities and must exercise proper precaution to verify figures shown on drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.

3.3 WORKMANSHIP

- A. Install all work neat, trim, parallel and plumb with building lines in accordance with standard trade practice acceptable to the Architect.

3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect all equipment and materials from damage during transportation, storage and installation.

3.5 PROTECTION

- A. Protect all work, equipment and materials during construction up to the time of acceptance by the Owner.
- B. Arrange and design the protection to prevent damage from infiltration or dust, debris, moisture, chemicals and water. Cap or plug electrical raceways.

3.6 EXCAVATION

- A. The excavation shall be of the open-trench method and to the depths and widths as may be necessary. The Contractor shall do all excavation required in connection with his work. Bottoms of trenches shall be excavated to a uniform grade. All materials excavated shall be deposited on the side of the trenches and beyond the reach of slides. Excavated material shall not be piled where it will interfere with traffic.
- B. No conduits shall be bedded directly on rock. They shall be cushioned by a 6-inch layer of crushed stone or gravel of selected grade, of size to pass through a 3/4" mesh sieve. Not less than 30% shall be fine which will pass through a 3/8" mesh sieve.
- C. Where excavation is required through tree root areas, roots shall be saw cut, treated with pruning paint and covered with burlap. Burlap shall be wet and shall be protected and maintained in a moist condition during entire period of exposure. Backfill shall be carefully placed and hand-tamped to a minimum of 6" above roots.
- D. Bidder shall base his estimate upon the presumption that all excavation required in the performance of this Contract will be earth. If rock is encountered, Contractor will be reimbursed for the additional work required to remove same based upon the unit cost established in the proposal.
- E. All detached boulders or loose stone not exceeding 1 cubic yard, all topsoil, sand, gravel, clay, rubbish, walls or other subgrade construction, and all other materials of every name and nature which can be removed without breaking up with pneumatic breakers shall be considered earth excavation.
- F. All rocks, attached boulders, boulders exceeding 1 cubic yard, walls or other subgrade construction and materials which cannot be removed without breaking up with pneumatic equipment shall be considered rock excavation.
- G. Before commencing any rock excavation for which extra compensation is to be paid, a rock contour drawing shall be prepared by the Contractor and checked by the Architect. The width shall be based on 2'-0". This rock contour drawing and width allowance will be used to compute the quantity of rock for which the Contractor will be reimbursed at the unit price established.

3.7 SHORING AND PUMPING

- A. The Contractor shall provide all shoring, bracing or sheet piling necessary to maintain the banks of his excavation and shall take out same as the work progresses and filling in has been accomplished. Shoring shall be in accordance with OSHA Standards.
- B. The arrangement of shoring must be such as to prevent any movement of the trench banks and consequent strains on the conduits. Shoring shall be provided to prevent damage to work installed by other trades.
- C. The Contractor shall do all pumping required to keep his excavations free of water. The water shall be conveyed in piping or watertight troughs a sufficient distance that it will flow from the site and not affect other work being performed.

3.8 BACKFILLING

- A. After work in trenches has been completed, they shall be filled with good, clean, fine earth in 8"

layers and shall be pneumatically tamped before the next layer of material has been filled in. The backfill shall be free of excavated rock, cinders, stones, brickbats or other debris.

- B. Wherever rock is removed, the Contractor shall secure and fill select clean earth to a minimum depth of 3'-0" above the top of the conduit. Unless otherwise indicated, no rock shall be deposited in the trench fill. This clean earth fill shall be procured other than from the site unless permission for earth borrow from the site is granted by the Architect. If site borrow is permitted, the topsoil removal, relocation and finished grading will be accomplished as directed by the Architect.
- C. Under no circumstances shall excavated material be left where it will interfere with the Owner's or other Contractor's operations.
- D. All earth and other materials taken from the trenches and not required for backfilling shall be deposited where directed, or removed from the premises as directed by the Architect.
- E. Any rock removed from the excavation shall be removed from the project site by the Contractor.
- F. Trenches which pass under wall footings or within 18" of column footings shall be backfilled with clean concrete. To secure adequate foundation support, the method and depositing of the concrete fill shall be as directed by the Architect. To prevent the concrete from adhering to the conduits, necessary conduit protection shall be applied.

3.9 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of two years of operation from date of acceptance by the Owner unless otherwise specified in Division 1.
- B. Guarantee shall be extended on an equal time basis for all non- operational periods due to failure within the guarantee period.

END OF SECTION

SECTION 26 01 10

RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.
- B. Refer to Section 260000 for General Provisions - Electrical.

1.2 DESCRIPTION OF WORK

- A. Types of raceways in this section include the following:
Polyvinyl chloride conduit (Exterior Underground Only)

1.3 REFERENCE STANDARDS

- A. Refer to Section 260000 for a general description of requirements applying to this Section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 260000 for a general description of requirements applying to this Section.

1.5 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

1.6 COORDINATION

- A. The drawings and details there upon are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all raceways, raceway supports, junction boxes and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.
- B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.
- C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Polyvinyl Chloride Conduit:

1. Raceway: Heavy wall, rigid non-metallic, schedule 40 with bell type end, designed for above ground exposed applications, direct earth burial, and concrete encasement.
2. Fittings: Polyvinyl chloride, heavy duty, glue type, designed for Schedule 40 application.
3. Subject to compliance with requirements, provide products of one of the following:

Allied Tube & Conduit

Carlson

Queen City Plastics, Inc.

Scepter Electric Systems

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS

- A. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.
- B. Coordinate with other work as necessary to interface installation of electrical raceways, wireways and required components.
- C. Raceways used for distribution, feeders, or branch circuits shall be a minimum size of 3/4" or equal equivalent cross-sectional area. Raceways used for control and signal shall be a minimum size of 1/2" or equal equivalent cross-sectional area.
- D. Complete the installation of electrical raceways before starting the installation of cables/wires within the raceway.
- E. Furnish and install one (1) nylon or fiberglass pull cord in each empty raceway. Each empty raceway shall be cleaned, capped, and tagged as to its termination location.
- F. Refer to Section 260000 for excavation, shoring and pumping, concrete and backfilling requirements.

3.2 CLEANING

- A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION

SECTION 26 01 20

WIRES AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. This section is a Division 26 Basic Materials and Methods section and is part of each Division 26 Section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK

- A. Electrical wire and electrical cable work is indicated by drawings and specifications.
- B. Arrange for and coordinate with the Utility Company and pay any and all costs in conjunction with the 25KV primary service from the point of connection to 25KV pad-mounted transformer.
- C. Types of wire, cable and connectors in this section include, but not limited to the following:
 - Copper conductors.
 - Tap type connectors.
 - Split-bolt connectors.
- D. Refer to other sections of Division 26 for, but not limited to, raceways, connections used in conjunction with wire and cable work.
- E. Applications for wire, cable and connectors required for project are as follows unless otherwise indicated:
 - 1. Primary Service Circuitry.
 - 2. Power Distribution Circuitry.
 - 3. Appliance and Equipment Circuitry.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Wire and Cable
 - Anaconda Wire and Cable Co.
 - Advance Wire and Cable, Inc.
 - American
 - Cerro Wire and Cable Co.

Electrical Conductors, Inc.

General Cable Corp.

Rome Cable Corp.

Southwire Company

Triangle PWC., Inc.

The Okonite Co.

General Electric Co.

Connectors

Burndy Corp.

Eagle Electric Mfg. Co., Inc.

Gould, Inc.

Ideal Industries, Inc

Joslyn Mfg. and Supply Co.

O-Z/Gedney Co.

Pyle National Co.

Thomas and Betts Co.

2.2 WIRE, CABLE AND CONNECTIONS

- A. Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation. Minimum wire and cable size is #12 AWG for power and branch circuits and #14 AWG for control and signal/communication circuits unless otherwise indicated.
- B. Wire: Provide factory fabricated wire of sizes, ratings, materials and types indicated for each service. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements and NEC standards. Select from the following types, materials, conductor configurations, insulation and coverings:

UL Type: THHN

UL Type: TW

UL Type: THW

UL Type: THWN

UL Type: TF

UL Type: XHHW

Material: Aluminum (Primary Service Entrance Only)

Copper

Conductors: Solid (AWG 14 to AWG 10 only).

Conductors: Concentric-lay-stranded (standard flexibility)

Outer Covering: Nylon

Outer Covering: Thermoplastic

- C. Connectors: Provide factory fabricated metal connectors of sizes, ratings, materials, types and classes as required for each service. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and NEC standards. Select from the following types, classes, kinds and styles.

Type: Pressure

Type: Crimp

Type: Threaded

Class: Insulated

Class: Non-insulated

Kind: Copper (for CU to Cu connection).

Style: Butt connection

Style: Elbow connection

Style: Combined "T" and straight connection

Style: "T" connection.

Style: Split-bolt parallel connection

Style: Tap connection

Style: Pigtail connection

- D. 25KV Cable: Provide factory fabricated and tested primary service cable; underground residential distribution (URD) type cable, size #1/0 AWG solid aluminum conductor with 25KV cross-linked polyethylene insulation (XLP) with tinned or coated copper wire full size concentric neutral as approved by the Utility Company.

- E. 25KV Terminations: Provide 25KV terminations for 25KV #1/0 AWG solid aluminum cable as approved by the Utility Company in quantities required by the Utility Company.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install electrical cables, wires and connectors, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface. Pull conductors together where more than one is being installed in a raceway. Use pulling compound or lubricate, where necessary; compound must not deteriorate conductor or insulation. Use pulling means including fish tape, cable or rope which cannot damage raceway. Rope must be used as pulling means when pulling wires or cables into plastic conduit and duct. Keep conductor splices to a minimum and install in junction boxes only. No splices shall be permitted within conduit. Install splices and tapes which have mechanical strength and insulation rating equivalent or better than conductor. Use splice and tape connectors which are compatible with conductor material.
- C. Installation of 25KV primary service cable with the Utility Company.
- D. Deliver 25KV cable terminations to the Utility Company for installation and connection.

3.2 FIELD QUALITY CONTROL

- A. Prior to energization, test cable and wire for continuity of circuitry and also for short circuits. Correct malfunctions when detected.
- B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.
- C. Test 25KV cable after installation using D.C. high potential (Hi-Pot) testing. All testing shall be performed in accordance with cable manufacturer's recommended specifications. Keep a complete record of all tests and submit to the Engineer upon completion. Testing shall be performed by an independent cable testing company or service.

END OF SECTION

SECTION 26 01 30

MANHOLES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of manholes and manhole installation work is indicated by drawings and specifications.
- B. Types of manholes in this section shall include the following:
 - 1. Precast concrete
 - 2. Poured in place
 - 3. Polymer Concrete

1.2 SUBMITTALS

- A. Submit manufacturer's data on manholes including, but not limited to, roughing-in drawings, construction details and structural support data.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide manholes with frame and cover, and cable accessories of one of the following:
 - 1. Manholes - A.C. Miller Concrete Products, Inc.
 - Gillespie Precast, LLC
 - Quazite
 - 2. Frame and Cover - Neenah Foundry Co.
 - Quazite

2.2 STANDARD MANHOLES

- A. Manholes shall be a precast concrete box with interior dimensions of 48" wide x 48" long x 48" deep with 6" walls, floor and top.
- B. Floor shall be provided with a ground rod hole, pulling irons and a 12" diameter x 12" deep sump.
- C. Top shall be a precast 6" slab with a circular opening suitable for a manhole frame opening of 32-1/2."
- D. The precast 6" top slab shall be sealed where it joins the manhole. The entire exterior surface of the manhole shall be coated with a bitumastic type waterproof coating prior to installation.

2.3 MANHOLE FRAME AND COVER

- A. Frame and cover shall be a round, heavy duty, cast iron frame and solid cover with machined horizontal bearing surfaces. Total weight to be approximately 365 pounds.
- B. Frame and cover dimensions shall be as follows:
 - 1. Overall frame size = 38-1/2"
 - 2. Clear opening size = 32-1/2"
 - 3. Overall frame height = 4"
- C. Cover shall have the word, "Electric", cast into it.
- D. Frame and cover shall be similar in manufacture to Neenah Foundry Company Model No. R-1792-HL.

2.4 GROUND ROD AND CLAMP

- A. Ground rod shall be a rigid steel rod with a heavy duty, uniform, non-porous copper coating. Rod to be 3/4" dia. x 10'-0" long. Clamp to be cast of high copper content bronze alloy.
- B. Ground rod assembly to consist of the following:
 - 1. Ground rod - Blackburn Cat. No. W5810
 - 2. Ground Clamp - Blackburn Cat. No. J-JR.

PART 3 – EXECUTION

3.1 INSTALLATION OF MANHOLES

- A. Install manholes in accordance with manufacturer's written instructions and complying with applicable portions of NEC and NECA's "Standard of Installation."
- B. Manholes shall be oriented in accordance with duct bank requirements as indicated on the electrical site plan. The depth of the manhole shall be as required to allow the frame and cover to set level with finished grade.
- C. Manholes shall not be set in an area or at an elevation which will allow surface water or runoff to enter manhole through the cover. Should this occur, this Contractor will be required to raise the frame and cover and regrade the area.

3.2 FIELD QUALITY CONTROL

- A. Contractor shall inspect the conduit entrances into the manhole looking for broken ducts and/or rough edges and repairing the findings. Contractor shall also check that conduit entrances are sealed to keep out ground water.

- B. All manholes shall be cleaned of dirt and construction debris. All spare conduits shall have a nylon pull cord installed for future use.

END OF SECTION

SECTION 26 05 20

ROADWAY & PARKING AREA LIGHTING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of roadway and parking area lighting work is indicated by drawings and schedules.
- B. Applications of roadway and parking area lighting in this section include the following:
 - Private roadways.
 - Automobile parking lots.
 - Pedestrian walkways.
- C. Excavation and backfilling for roadway and parking area lighting poles, standards and foundations are specified in applicable Division 26 General Provisions sections.
- D. Concrete for embedding poles, and for pole foundations and footings are specified in applicable Division 26 General Provision sections.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's data on roadway and parking area lighting units, including certified dimension drawings of components including, but not necessarily limited to, fabricated poles and standards, and hardware.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Provide concrete bases, standards and luminaries of sizes, types and ratings indicated; complete with but not necessarily limited to anchor bolts, housings, lamps, lampholders, reflectors, ballasts, starters, lighting brackets and wiring; wired and connected in place, tested and left in satisfactory operating condition. See schedule on the drawings for types of standards and luminaries. Type letters are keyed with fixture letters indicated at the outlets on the drawings.
- B. Material: Extruded aluminum.
- C. Configuration: Anchor base type with handhole and cover.
- D. Metal Lighting Standard Accessories: Provide accessories for metal lighting standards, including anchor bolts, as recommended by standard manufacturer of sizes and materials needed to fulfill loading and erection application requirements.
- E. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of roadway and parking area lighting unit): As specified under "PRODUCTS".

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install roadway and parking area lighting units as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NESC and NEMA standards, and with recognized industry practices to ensure that lighting units fulfill requirements.
- B. Use belt slings or rope (not chain or cable) to raise and set finished poles and standards to protect finishes.
- C. Set poles and standards plumb. Support adequately during backfilling, or anchoring to foundations.

3.2 ADJUST AND CLEAN

- A. Clean standards and luminaries of dirt and debris upon completion of installation.
- B. Protect standards and luminaries from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of roadway and parking area lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. At the time of Substantial Completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after Contractor's testing, as judged by Architect/Engineer.

3.4 GROUNDING

- A. Provide tight equipment grounding connections for each lighting fixture installation.

END OF SECTION

**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. Section Includes:**

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
2. Division 01 Section "Execution" for field engineering and surveying.
3. Division 01 Section(s) "Construction Waste Management and Disposal and "Sustainable Design Requirements" for additional LEED requirements.
4. Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.
5. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings or structures.

C. Delaware Department of Transportation (DelDOT) Standard Specifications.**D. Delaware Department of Natural Resources and Environmental Control (DNREC) Erosion and Sediment Control Handbook.****1.3 DEFINITIONS**

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

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- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally 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 non-soil materials.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

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

1.5 SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

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

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.

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- 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.
- C. Utility Locator Service: Notify Miss Utility (1-800-282-8555) for area where Project is located 72-hours before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- E. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving" and the project Soils Report

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain.
- C. 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 erosion- and sedimentation-control Drawings in accordance with the DNREC Erosion and Sediment Control Handbook.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

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- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal upon approval of DNREC and the owner.

3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING 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 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. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting 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.
- E. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 3. Use only hand methods for grubbing within protection zones.
 - 4. Removed tree branches to be disposed off-site by the contractor.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

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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.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to the depth found in the Geo-technical Report in a manner to prevent intermingling with underlying subsoil or other waste materials.
 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Stabilize stockpiles in accordance with the DNREC Erosion and Sediment Control Handbook.
 1. Limit height of topsoil stockpiles to 10 feet.
 2. Do not stockpile topsoil within protection zones.
 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and 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 along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. 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.
- B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

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SECTION 31 20 00
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.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for all aspects of construction shown on the plans.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for recording pre-excavation and earth moving progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
3. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Division 14 Section "Hydraulic Elevators" and "Hydraulic Freight Elevators" for excavating well hole to accommodate elevator-cylinder assembly.
5. Divisions 21, 22, 23, 26, 27, 28, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
6. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
7. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
8. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
9. Division 31 Section "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
10. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
11. Division 32 Section "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.
12. Division 33 Section "Sub-drainage".

- C. Delaware Department of Transportation (DelDOT) Standard Specifications.
- D. Delaware Department of Natural Resources and Environmental Control (DNREC) Sediment and Erosion Control Handbook.

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

1.4 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Base Course aggregate
 - 4. Drainage Course aggregate.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Pre-excavation Conference: Conduct conference at Project site.

1.6 PROJECT 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. Utility Locator Service: Notify Miss Utility (1-800-282-8555) for area where Project is located before beginning earth moving operations.
- C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Site Clearing are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

1. All on-site borrow, subbase material, base course and drainage course shall be as shown on the plans and in accordance with the DelDOT Standard Specifications.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters meeting Mirafi 140N or approved equal.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters meeting Mirafi 600X or approved equal.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils 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.
 6. 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.

3.4 EXCAVATION, GENERAL

- A. All excavation shall be as shown on the plans and in accordance with the DelDOT Standard Specifications and the DNREC Sediment and Erosion Control Handbook.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. 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.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand 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. Cut and protect roots according to requirements in Division 01 Section "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 higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- 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.

3.8 SUBGRADE INSPECTION

- A. Notify Architect/Engineer/Construction Manager when excavations have reached required subgrade.
- B. If Architect/Engineer/Construction Manager determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, 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 may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

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 as shown on the plans and in accordance with the DelDOT Specifications.

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 Division 03 Section Cast-in-Place Concrete.
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

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 and compact fill as shown on the plans and in accordance with the DelDOT Standard Specifications.

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.

3.17 SUBSURFACE DRAINAGE

A. Sub-drainage Pipe: Specified in Division 33 Section "Sub-drainage."

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place as shown on the plans and in accordance with the DelDOT Standard Specifications.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

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

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. 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.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and 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. 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.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact 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 Architect; reshape and re-compact.
- 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 Architect.
 - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

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**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.
 3. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 4. Division 33 Section "Sub-drainage" for permanent foundation wall, underfloor, and footing drainage.
- C. Delaware Department of Transportation (DelDOT) Standard Specifications.
- D. Delaware Department of Natural Resources and Environmental Control (DNREC) Sediment and Erosion Control Handbook.

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.

1.4 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. Field quality-control reports.
- C. Other Informational Submittals:

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with DNREC notification regulations before beginning dewatering. Comply with hauling and disposal regulations of the DNREC Sediment and Erosion Control handbook

1.6 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 Owner no fewer than two days in advance of proposed interruption of utility.
- 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 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.
- 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. 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.
- E. 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.
- F. 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 31 23 19

SECTION 32 12 16
ASPHALT PAVING**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. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Pavement-marking paint.
6. Paving Geotextile fabric

B. Related Sections:

1. Division 02 Section "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

C. Delaware Department of Transportation (DelDOT) Standard Specifications.

D. Delaware Department of Natural Resources and Environmental Control (DNREC) Erosion and Sediment Control Handbook.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: See DelDOT Standard Specifications.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: For each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Material Certificates: For each paving material, from manufacturer.
- D. Material Test Reports: For each paving material.
- E. Paving Geotextile Fabric

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by DelDOT.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of DelDOT for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- D. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: See DeIDOT Standard Specifications
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: All aggregates for asphalt paving are in accordance with the DeIDOT Standard Specifications.

2.2 ASPHALT MATERIALS

- A. All asphalt materials are in accordance with the DeIDOT Standard Specifications. Retain first paragraph below with option for viscosity- or penetration-graded asphalt cement if these materials are available and required. Viscosity testing measures properties more accurately than penetration testing. Insert viscosity or penetration grades below if required.

2.3 AUXILIARY MATERIALS

- A. Paving Geotextile Fabric: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- B. Joint Sealant: Per the DeIDOT Standard Specifications.
- C. Pavement-Marking Paint: As shown on the project plans and in accordance with the DeIDOT Standard Specifications.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by DeIDOT and in accordance with the DeIDOT Standard Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment 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. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of 2 inches.
 - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
 - 3. Control rate of milling to prevent tearing of existing asphalt course.
 - 4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
 - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
 - 6. Transport milled hot-mix asphalt to asphalt recycling facility.
 - 7. Keep milled pavement surface free of loose material and dust.

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving in accordance with the DelDOT Standard Specifications.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Prime Coat: In accordance with the DelDOT Standard Specifications.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement in accordance with the DelDOT Standard Specifications.

3.5 PAVING GEOTEXTILE INSTALLATION

- A. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
 1. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted in accordance with the DelDOT Standard Specifications.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers in accordance with the DelDOT Standard Specifications.
- B. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- C. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- D. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the tolerances found in the DelDOT Standard Specifications.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the tolerances found in the DelDOT Standard Specifications.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.
- B. Allow paving to age for 14 days before starting pavement marking unless directed by Engineer to start pavement marking prior to 14-days.
- C. Sweep and clean surface to eliminate loose material and dust.
 1. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- C. In-Place Density: In accordance with the DeIDOT Standard Specifications.

3.12 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in a DNREC approved landfill.

END OF SECTION 32 12 16

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SECTION 32 12 16.1
TRACK & TENNIS BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 00 00 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK

- A. Work Included: Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. Construction of dense graded crushed stone base course for all new paved areas.
 - 2. Rough grading and compaction of base material.
 - 3. New bituminous concrete running track and field event areas and tennis courts.

1.03 RELATED WORK

- A. Cast-In-Place Concrete
- B. Cement Concrete Pavement
- C. Athletic Equipment
- D. Earthwork
- E. Resilient Track Surface
- F. Chain Link Fence and Gates

1.04 REFERENCES

- A. Work shall conform to codes and standards of the following:
 - 1. ASTM – American Society of Testing Materials
 - 2. AASHTO – American Association of State Highway and Transportation Officials
 - 3. State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.
 - 4. Delaware Interscholastic Athletic Association (DIAA).
 - 5. International Association of Athletics Federations (IAAF).
 - 6. American Sports Builders Association (ASBA)
 - 7. National Federation of State High Schools (NFHS)

1.05 QUALITY ASSURANCE

- A. Codes and standards: Perform site improvement work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Qualifications of workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- C. Track paving crew shall have a demonstrated history of successfully paving running tracks. Crew leaders and all laborers shall have paved at least five (5) running tracks in the last three (3) year period.
- D. Layout and Grading: After staking and layout out the work, and before beginning final construction, obtain the Landscape Architect's/Civil Engineer's approval of layout and grades. Contactor shall make minor adjustments as determined by the Landscape Architect/Civil Engineer.
- E. The Contactor and his Subcontractors shall inspect all subbases for unstable, unsuitable or improperly prepared areas. Do not begin work over unacceptable areas. Beginning work means the Contractor and his Subcontractors accept the subbase, previous work and conditions and shall be held responsible for any corrections required to properly implement the Construction Documents.

1.06 SUBMITTALS

- A. Product Information: Provide manufacturer's data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation. Work includes but is not limited to the following items:
 - 1. Bituminous Concrete – mix data for binder course and surface course
 - 2. Resumes of track and tennis paving foreman and crew
 - 3. List of five (5) track references of paving crew

1.07 JOB CONDITIONS

- A. Environmental Requirements: The Subcontractor shall verify site conditions to assure that the requirements for installation procedures conform to the following:
 - 1. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
 - 2. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40 deg F (4 deg C) and when base is dry. Base course may be placed when air temperature is above 30 deg F (minus 1 deg C) and rising.
 - 3. After final rolling of bituminous concrete pavement, no vehicular traffic of any kind shall be permitted until it has cooled for 24-hours.
- B. Site Information: Data on indicated grades, utilities and other existing conditions are not intended as representations or warranties of accuracy.
- C. Existing Utilities: Locate existing utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during installation of site improvements.

- D. Protection: The Contractor shall use all means necessary to protect the materials of this Section before, during and after installation. In the event of damage, make all repairs and replacements necessary to approval of the Landscape Architect/Civil Engineer and at no additional cost to the Owner. All work shall be executed in such a manner as to prevent any damage to existing streets, curbs, paving to remain, existing fencing, existing plant materials, and adjoining properties.
- E. The Contractor shall remove all debris, construction equipment and scrap material from areas within the limit of work prior to inspection for acceptance.
- F. The Drawings indicate, in general, the alignment and finished grade elevations. The Landscape Architect/Civil Engineer, however, may make minor adjustments to grades and alignments as are found necessary.

PART 2 PRODUCTS

2.01 GENERAL

- A. Use locally available materials and gradations that exhibit a satisfactory record of previous installations.

2.02 DENSE GRADED CRUSHED STONE (AGGREGATE BASE COURSE)

- A. Course Aggregate: Sound, angular crushed stone, crushed gravel, or properly cured crushed blast furnace slag, complying with ASTM D 692-88.
- B. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, properly cured blast furnace slag, gravel, or combinations thereof, complying with ASTM D 1073.
- C. The Contractor shall submit to the Landscape Architect/Civil Engineer a sieve analysis by an independent recognized testing laboratory of the material he intends to utilize. No material shall be placed until approved by the Landscape Architect/Civil Engineer in writing.
- D. Dense Graded Crushed Stone for all new pavement shall consist of two (2) lifts with a minimum finished after rolling and compaction of twelve (12") inches.

2.03 400 METER RUNNING TRACK (INCLUDING FIELD EVENT AREAS) AND TENNIS COURTS, BITUMINOUS CONCRETE PRODUCT MIX REQUIREMENTS:

- A. Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with ASTM D 3515 and applicable Delaware Department of Transportation standards.
- B. Bituminous concrete for the 400-meter running track (including field event areas) and tennis courts shall conform to 2.03.A above, and shall consist of two (2) courses of bituminous concrete with a minimum finished pavement depth after rolling of three (3") inches.
 - 1. Binder course shall be two (2") inches in thickness consisting of one lift Binder Course bituminous concrete.
 - 2. Surface course shall be one (1") inch in thickness consisting of one course of Dense Mix bituminous concrete.
- C. Reclaimed Asphalt Pavement (RAP) may be used in Binder Course. The proportion of RAP to virgin aggregate shall be limited to a maximum of 20% for drum mix plants and 10% for modified batch plants, or as approved by the Landscape Architect/Civil Engineer. The maximum amount of RAP for surface courses shall be 0%.

- D. Bituminous concrete for the 400-meter track (including field event areas) and tennis courts, shall comply with American Sports Builders Association's Asphalt Guidelines.

2.04 BITUMINOUS MATERIALS

- A. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
- B. Prime Coat: Cut-back asphalt type, ASTM D 2027; MC-30, MC-70 or MC-250.
- C. Tack Coat: Emulsified asphalt; ASTM D 977.

PART 3 EXECUTION

3.01 GRADING AND PREPARATION OF EXISTING BASE COURSE (SUBGRADE)

- A. Areas to be paved will be compacted and brought approximately to subgrade elevation before work of this Section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.
- B. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to this Section.
- C. Subgrade of areas to be paved shall be re-compacted as required to bring top 8 inches of material immediately below bituminous concrete pavement to a compaction of at least 95% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 foot beyond pavement edge.
- D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Landscape Architect/Civil Engineer. Completed subgrade after filling such areas shall be uniformly and properly graded.
- E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 inches deep in subgrade, shall be graded out, reshaped as required, and re-compacted before placing dense graded crushed stone base course materials and pavement.
- F. Materials shall not be stored or stockpiled on subgrade.
- G. Disposal of debris and other material excavated and/or stripped under this Section, and material unsuitable for or in excess of requirements for completing work of this Section shall be legally disposed off-site, unless otherwise directed by the Landscape Architect/Civil Engineer or Owner.
- H. Prepared subgrade will be inspected by the Landscape Architect/Civil Engineer. Subgrade shall be approved by the Landscape Architect/Civil Engineer before installation of bituminous concrete pavement. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

3.02 DENSE GRADED CRUSHED STONE BASE COURSE

- A. Dense graded crushed stone base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and shall follow the State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.
- B. Compaction of dense graded crushed stone base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2-1/2 inches shall be excluded from aggregate base course materials.
- C. Width of dense graded crushed stone base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.
- D. Dense graded crushed stone material shall be applied in lifts less than or equal to 6 inches thick, compacted measure. Each lift shall be compacted to project specified density with compaction verified by performance of on-site field density testing.
 - 1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
 - 2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
 - 3. Surface irregularities which exceed 1/2 inch measured by means of a 10-foot long straightedge shall be replaced and properly compacted.
- E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with dense graded crushed stone base course. Materials spilled outside pavement lines shall be removed and area repaired.
- F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.03 BITUMINOUS PAVING

- A. Bituminous paving mixture, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base, etc., shall conform to Delaware DOT Specifications and as noted below.
- B. Bituminous binder and surface courses shall each be applied individually, in single lifts of full thickness as indicated on the Drawings.
- C. Adjacent concrete work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original condition.
- D. Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to Landscape Architect/Civil Engineer, is provided. Loads which have been wet by rain or otherwise will not be accepted. Hauling over freshly laid or rolled material will not be permitted.
- E. Placing and rolling of mixture shall be as nearly continuous as possible. Rolling shall begin as soon after placing as mixture will bear the operation without undue displacement. Delays in rolling freshly spread mixture will not be permitted. Rolling shall proceed longitudinally,

starting at edge of newly placed material and proceeding toward previously rolled areas. Rolling overlap on successive strips shall be greater than or equal to ½ width of roller rear wheel. Alternate trips of roller shall be of slightly different lengths. Corrections required in surface shall be made by removing or adding materials before rolling is complete. Skin patching of areas where rolling has been complete will not be permitted. Course shall be subjected to diagonal rolling, crossing lines of the first rolling while mixture is hot and in compactable condition. Displacement of mixture or other fault shall be corrected at once by use of rakes and application of fresh mixture or removal of mixture, as required. Rolling of each course shall be continued until roller marks are eliminated. Roller shall pass over unprotected edge of course only when paving is to be discontinued for sufficient time to permit mixture to become cold.

- F. In places not accessible to roller, mixture shall be compacted with hand tampers. Hand tampers shall weigh at least 50 lbs. and shall have a tamping face less than or equal to 100 square inches. Mechanical tampers capable of equal compaction will be acceptable in areas, which they can be employed in the work.
- G. Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced, replaced with fresh mixture, and compacted to density of surrounding areas. Bituminous material spilled outside lines of finished pavement shall be immediately and completely removed and the areas restored. Such material shall not be employed in the work.
- H. Joints shall present same texture, density, and smoothness as other sections of the course. Continuous bond shall be obtained between portions of existing and new pavements between successive placements of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.
- I. Contact surfaces of previously constructed pavement (if greater than or equal to seven days since binder placed), manholes, and similar structures shall be thoroughly cleaned and painted with a thin uniform coating of bitumen immediately before fresh mixture is placed. Tack coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 sq. yd. after evaporation of vehicle. Base surface shall be dry and clean tack coat is applied. Bituminous paving material shall not be placed until vehicle has completely evaporated from tack coat. Adjoining new paving shall be placed before tack coat has dried or dusted over.
- J. Earth or other approved material shall be placed along pavement edges in such quantity as will compact to thickness of course being constructed, allowing at least 1 foot of shoulder width to be rolled and compacted simultaneously with rolling and compacting surface. Pavement edge shall be trimmed neatly to line before placing earth or other approved material along edge.
- K. After final rolling, vehicular traffic shall not be permitted on pavement until it has cooled and hardened, and in no case less than six hours.
- L. Variations in smoothness of finished surface shall be less than or equal to the following tolerances when tested with a 10 foot straightedge, applied both parallel to and at right angles to centerline of paved area.
 - 1. For track and tennis binder courses – 1/4 inch in 10 feet.
 - 2. For track and tennis surface courses – 1/8 inch in 10 feet.
 - 3. At joint with existing pavement, and at other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed 0.01 feet.

4. At other areas pavement elevation tolerance shall not exceed ± 0.05 feet.
 5. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this Specification.
- M. The Contractor shall check the final surface for depressions by applying water in the presences of the Landscape Architect/Civil Engineer. Minor depressions (less than 1/8" in depth) need not be corrected, however, in cases where the variation in the surface course exceeds 1/8", the entire area affected shall be removed and replaced with new surface course at the expense of the Contractor.

END OF SECTION

**SECTION 32 13 13
CONCRETE PAVING****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. Walks.
2. Concrete Pavement
3. Concrete Pads
4. Concrete Curb

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

C. Delaware Department of Transportation (DelDOT) Standard Specifications.

D. Delaware Department of Natural Resources and Environmental Control (DNREC) Sediment and Erosion Control Handbook.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

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

- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

- C. Other Action Submittals:

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

D. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.
8. Aggregates and sand materials.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with the DeDOT Standard Specifications.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 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.

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

1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Quality control of concrete materials and concrete paving construction practices.
2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Concrete paving subcontractor.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces in accordance with the DeIDOT Standard Specifications.
- B. Form-Release Agent: In accordance with the DeIDOT Standard Specifications

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A185/A185M, fabricated from steel wire into flat sheets as shown on the plans and in accordance with the DeIDOT Specifications.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - a. Portland Cement: Per the DeIDOT Standard Specifications.
- B. Normal-Weight Aggregates: Per the DeIDOT Standard Specifications.
- C. Water: Per the DeIDOT Standard Specifications.
- D. Air-Entraining Admixture: Per the DeIDOT Standard Specifications.

2.4 CURING MATERIALS: All curing shall be in accordance with the DeIDOT Standard Specifications.

2.5 RELATED MATERIALS

- A. Joint Fillers: In accordance with the DeIDOT Standard Specifications.

2.6 CONCRETE MIXTURES

- A. All concrete shall be Type "B" (3,000 PSI) in accordance with the DeIDOT Standard Specifications.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete in accordance with the DeIDOT Standard Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: In accordance with the DeIDOT Standard Specifications.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 2. Provide tie bars at sides of paving strips where indicated.
 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet for paving and 20 feet for sidewalks and curbing unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness at 25-foot intervals for paving and 5-feet for sidewalks.
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

- A. Placement of concrete shall be as shown on the plans and in accordance with the DelDOT Standard Specifications.

3.7 FLOAT FINISHING

- A. Float finishing shall be in accordance with the DelDOT Standard Specifications.

3.8 CONCRETE PROTECTION AND CURING

- A. Concrete protection and curing shall be in accordance with the DelDOT Standard Specifications.

3.9 PAVING TOLERANCES

- A. Paving tolerances shall be in accordance with the DelDOT Standard Specifications.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: In accordance with the DelDOT Standard Specifications.
 - 2. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - 3. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if 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.
- D. Test results shall be reported in writing to Architect, 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.
- E. Concrete paving will be considered defective if it does not pass tests and inspections.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

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**SECTION 32 15 40
STONE DUST PAVING****PART 1 - GENERAL****1.1 GENERAL REQUIREMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Examine all other Sections of the Specifications for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 WORK INCLUDED

- A. Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. Provide crushed aggregate screenings/stone dust (CAS) paving, complete as shown for the shot-put throwing area.
- B. Related Sections include:
 - 1. Earthwork
 - 2. Cast-in-place Concrete
 - 3. Precast Concrete Curb
 - 4. Natural Grass Athletic Field Surface

1.3 REFERENCES

- A. Work shall conform to codes and standards of the following:
 - 1. ASTM - American Society for Testing and Materials
 - 2. State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.
 - 3. AASHTO - American Association of State Highway and Transportation Officials
 - 4. Americans with Disabilities Act (ADA).

1.4 QUALITY ASSURANCE

- A. Codes and standards: Perform site improvement work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Qualifications of workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- C. Layout and Grading: After staking and laying out the work, and before beginning final construction, obtain the Landscape Architect's/Civil Engineer's approval of layout and grades. Contractor shall make minor adjustments as determined by the Landscape Architect/Civil Engineer.
- D. The Contractor and his Subcontractors shall inspect all subbases for unstable, unsuitable or improperly prepared areas. Do not begin work over unacceptable areas. Beginning work means the Contractor and his Subcontractors accept the subbase, previous work and conditions and shall be held responsible for any corrections required to properly implement the Construction Documents.

- E. Submit certified documentation of successful experience of no less than three (3) years in the installation of similar crushed stone paving in comparable scale projects.
- F. Testing Agency: Selected by Owner and paid for by the Contractor.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect crushed stone from contamination with foreign materials. Isolate stockpiles to prevent mixing of different aggregate grades. Prevent contamination with organic materials.

1.6 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install work under this section prior to acceptance of the subgrade preparation under another section.
- B. Coordination: Coordinate with other trades to insure a proper installation schedule.

1.7 MAINTENANCE

- A. Service: Immediately repair all damage to the work as the result of weather or traffic conditions. Report all damage resulting from work of other trades after acceptance of work. Repair to match adjacent undisturbed work.

1.8 SUBMITTALS

- A. Product Data: Manufacturer’s current catalog cuts and specifications for decomposed granite (crushed aggregate screenings, CAS).
- B. Samples: Half (1/2) a pound for each size and color range of decomposed granite/crushed aggregate screenings.

PART 2 - PRODUCTS

2.1 CRUSHED AGGREGATE SCREENINGS (CAS)

- A. Crushed Aggregate Screening, or Stone Dust, shall consist of crushed limestone. All materials shall be well graded and free from unsuitable materials. All processing shall be completed at the source.
- B. Gradation:

Sieve Size Designation	Percent Passing by Weight
¼ inch	100
#10	55-75
#40	20-40
#200	7-15
- C. The Plasticity Index of the material passing the #40 mesh sieve shall not exceed 5.0.

2.2 EQUIPMENT

- A. Compaction Equipment: Power roller weighing not less than five (5) tons.

2.3 ACCESSORIES

- A. Water: Fresh, clean, potable water as available from the Owner or transported as required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that the adjacent paving or surfacing has been installed and accepted under another Section prior to commencement of work.
- B. Confirm elevation of throwing circles so that final CAS grade matches that elevation.

3.2 PREPARATION

- A. Compaction: Compact subgrade to a minimum of 95% compaction.

3.3 INSTALLATION

A. Stone Dust Paving

- 1. If the dump truck delivering the CAS is able to back-up to the prepared base, it is advisable to dump the first load at the entrance, spread by grading the CAS onto the base in a pushing mode and continue in this manner so the delivery vehicles reverse over the graded CAS to dump but do not actually travel directly onto prepared base
- 2. Lines and Levels: Install all crushed aggregate screenings work true to grade, properly coinciding with adjacent work and elevations. Provide a finished surface uniform in texture and appearance. Do not permit finished work to vary more than 1/8" in 10' from true profile and cross section.
- 3. Moisture Content: Add water to provide a uniformly distributed moisture to obtain the required compaction.
- 4. Compacting: Thoroughly compact each lift to a minimum of 95% Compact each area with at least four (4) passes of compacting equipment. After compacting, screed smooth.
- 5. Grading: When surface areas have been rolled and it becomes necessary to add a thin layer of material to bring the surface to grade, the previously rolled or compacted area shall be raked to provide a bond with the added material.
- 6. Damaged or Defective Installation: Repair and replace in accordance with these Specifications at no additional cost to the Owner.

3.4 PROTECTION

- A. Protect the paving against traffic, injury or defacement, or damage and subsequent construction operations until Final Acceptance.

END OF SECTION

SECTION 32 18 23.13**INFIELD MIX****PART 1 - GENERAL****1.01 GENERAL REQUIREMENTS**

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 010000 – GENERAL REQUIREMENTS, which are hereby, made a part of the Section of the Specifications
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 WORK INCLUDED

- A. Perform all work required to complete the work of this section, as indicated. Such work includes, but is not limited to the following:
 - 1. Furnishing and installing base material for infield and warning track from off-site sources as required completing the work.
 - 2. Furnishing and installing infield mix from off-site sources as required to complete the work
 - 3. Furnishing and installing warning track from off-site sources as required completing the work.
 - 4. Furnishing and installing batter's box fortification
 - 5. Furnishing and installing pitcher's circle fortification
 - 6. Furnishing and installing infield conditioner
 - 7. Furnishing and installing all line whiting for baseball and softball fields

1.03 RELATED WORK UNDER OTHER SECTIONS

- A. Site Athletic Equipment
- B. Cement Concrete Pavement
- C. Chain Link Fences and Gates
- D. Natural Grass Athletic Field Surface

1.04 SUBMITTALS

- A. Submit manufacturer's product data for each type of material and/or equipment required.
 - 1. Source and sieve information for Infield and Warning Track Base Material
 - 2. Source and sieve information for Infield Mix
 - 3. Source and sieve information for Warning Track Mix
 - 4. Pitcher's and Batter's Box Fortification
 - 5. Infield Conditioner

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured products in manufacturer's original, unopened, and undamaged containers with labels intact and legible.
- B. Store and handle manufactured products to prevent damage and deterioration.

1.06 PROJECT CONDITIONS

- A. General: The Contractor shall visit and accept the site as he finds it, and shall inform himself of the character and the type of site. The Contractor shall walk the site with the Landscape Architect prior to commencing work to determine the full scope of work.
- B. Damage or loss to site improvements shall be at the risk of the Contractor from and after the date of Contract execution, and no such damage or loss shall relieve the Contractor from any obligation under the Contract.
- C. Do not begin equipment work before completion of final grading and surfacing.

PART 2 – PRODUCTS

2.01 BASE MATERIAL

- A. Base Material for Skinned Infield and Warning Track shall be a mason sand and shall conform to the following analysis:

Sieve Size	Percent Passing (%)
#4	100
#8	95 – 100
#16	70 – 100
#30	40 – 75
#50	10 – 35
#100	2 – 14
#200	0 – 2

2.02 SKINNED INFIELd MIX

- A. Skinned Infield Mix shall be equivalent to DuraEdge Classic Infield Mix as provided by DuraEdge Products, Inc., 149 South Broad Street, Grove City, PA 16127, (724) 870-4250.
- B. Skinned Infield Mix shall be clean, dry clay mixed with washed mason-type sand resulting in a weed-free mixture that is reddish brown in color having a yield of 1.35 tons per cubic yard when placed loose or 1.5 tons per cubic yard when compacted 85% - 90% on a Standard Proctor Test (ASTM D 689-07). The material shall possess the following particle size analysis:
 - a. Total sand content shall be 70-75 percent.
 - b. The combined amount of sand retained on the medium, coarse and very coarse sieves shall be greater than or equal to 50 percent.
 - c. The combined amount of silt and clay shall be 25-30 percent.
 - d. The ratio of silt divided by clay, otherwise known as SCR, shall be 0.5-1.0.
 - e. No particles greater than 3 millimeters.
 - f. Equal to or less than 5 percent of particles shall be retained on the 2-millimeter sieve.

2.03 WARNING TRACK

- A. Warning Track Mix shall be equivalent to DuraEdge DuraTrax Warning Track Mix as

provided by DuraEdge Products, Inc., 149 South Broad Street, Grove City, PA 16127, (724) 870-4250.

- B. Warning Track Mix shall be clean, crushed brick mixed with #10 limestone resulting in a mix that is reddish brown in color, having a yield of 1.3 tons per cubic yard and possessing the following particle size analysis:

Sieve Size	Percent Passing (%)
3/8"	100
#4	90 – 100
#8	60 – 78
#16	42 – 55
#30	20 – 40
#50	8 – 20
#100	5 – 12
#200	0 – 5

2.04 INFIELD CONDITIONER

- A. Calcined Clay for skinned infield conditioner shall be equivalent to Turface Pro League Heritage Red as manufactured by Profile, (800) 207-6457.
- B. Final Color to be selected by Landscape Architect from manufacturer’s standard colors.

2.05 CLAY FORTIFICATION

- A. Clay Fortification shall be DuraPitch Premium Mound Clay as provided by DuraEdge Products, Inc., 149 South Broad Street, Grove City, PA 16127, (724) 870-4250.

2.06 LINE MARKING

- A. Whiting shall be a fine dry white powder prepared from natural chalk or olitic calcium carbonate, and shall be free from grit or deleterious impurities.
- B. Whiting shall show the correct microscopical characteristics of the kind required and shall comply with the following requirements:

		Minimum	Maximum
1.	Calcium Carbonate CaCo3	95.0%	-----
2.	Fe 0 and Al 0		-----
	1.0%		
3.	Water Soluble Matter	-----	0.5%
4.	Matter Insoluble in Dilute Hcl	-----	4.0%
5.	Passing 100 Mesh Sieve	100.0%	-----
6.	Retained on 200 Mesh Sieve	-----	1.0%
7.	Retained on 325 Mesh Sieve	-----	6.0%

PART 3 – EXECUTION

3.01 INSPECTION

- A. Obtain the written approval of the Landscape Architect for subgrade prior to installing the stone dust and spreading of the infield mix material. By spreading the infield mix material prior to receiving the written approval of the Landscape Architect, the

Contractor assumes acceptance of the subgrade condition and the responsibility to repair deficiencies resulting from incorrect grades at his sole cost.

3.02 PREPARATION

- A. Remove loose material and debris from base surface before installing Infield Mixes.
- B. Proper base preparation is essential in the performance of the Infield Mix. Base material should be leveled or laser graded to ensure Infield Mixes are at a uniform depth of 4" across entire field.
- C. Pre-soak base material with water prior to installing Infield Mix and allow to dry. Once dry, compact base to 95% compaction.
- D. Locate and layout all infield areas for softball field, including the pitcher's circle, as well as all field markings. Obtain Landscape Architect's acceptance of layout prior to installation.

3.03 INSTALLATION

- A. Infield mix and Warning Track shall be installed per manufacturer's specifications to a depth of 4".
- B. Provide ½" of Infield Conditioner over infield mix after leveling and settlement.
- C. Install Clay Fortification as follows:
 - 1. Excavate areas to receive fortification – batter's boxes and pitcher's circle – to a minimum 4.5" depth in areas shown on drawings.
 - 2. Thoroughly tamp and level subgrade and install packing clay. Maintain a uniform depth.
 - 3. Place material in lifts of 2 inches and compact with a 1-ton vibratory roller until an optimal compaction between 90 percent and 95 percent is achieved. Scarify the surface to facilitate bonding of the next lift and repeat until finish grade elevation is achieved.
 - 4. Cover with ½" Infield Conditioner and rolled to insure firm surface.
 - 5. Cover area with tarp or other impermeable cover for a period of not less than 24 hours.
- D. Lines marked on skinned area of softball field shall be carefully laid out and marked on the surface with specified whitening using a line marking machine.

3.04 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from installation.

END OF SECTION

**SECTION 32 18 23.26
NATURAL GRASS ATHLETIC FIELD SURFACING****PART 1 - GENERAL****1.01 GENERAL REQUIREMENTS**

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 SCOPE OF WORK

- A. Refer to the Drawings for the extent and details of this work.
- B. The work of this Section consists of athletic field construction and related work as shown on the Drawings or required herein and includes, but is not limited to the following:
 - 1. Screening stripped and stockpiled topsoil
 - 2. Providing and incorporating all soil amendments as required to complete the work of this Section
 - 3. Spreading, compacting and laser grading of all amended topsoil for athletic field construction
 - 4. Seeding of prepared athletic field surface
 - 5. Athletic field turf grass maintenance and guarantee

1.03 RELATED WORK

- A. Athletic Equipment
- B. Earthwork
- C. Site Preparation
- D. Infield Mix
- E. Chain Link Fence and Gates

1.04 SUBMITTALS

- A. To be included with the Bid:
 - 1. Provide Proof of Experience Criteria as outlined in QUALITY ASSURANCE below. Contractor shall provide project name, project start and completion date, contact name, address and telephone number for each project to enable such data to be validated prior to Contract Award.
- B. To be provided during the project:
 - 1. Product information on field construction and laser controlled hydraulically operated grading system and equipment.
 - 2. Amended Topsoil:
 - a. Contractor shall submit source information and sieve analyses for approval of all amendment materials he intends to use as components of the Amended Topsoil prior to blending operations.
 - 3. Seed:

- a. Submit seed grass mix data and name of supplier for approval.
4. All material testing requirements and results (refer to Material Testing section of this specification).
5. Fertilizer recommendations for the approved soils and product information on all soil additives for approval.
6. Survey (10' grid) of the finished grades of the amended topsoil prior to sodding operations.
7. Submit a draft 12-month maintenance plan for review and approval based on the final amended soil composition including the recommended timing for cultural maintenance operations for the first year. A Certified Sportsfield Manager certified through the Sports Turf Managers Association shall provide plan. Maintenance plan shall include, but may not be limited to, the following:
 - a. Pest Management
 - b. Fertilization
 - c. Core Aeration
 - d. Deep Tine Aeration
 - e. Dethatching Procedures

1.05 MATERIALS TESTING (SUBMITTALS TO BE PROVIDED DURING THE PROJECT)

- A. Testing of the subgrade materials (for compaction testing) and amended topsoil shall be performed and evaluated in accordance with the current standards of the Association of Official Agriculture Chemists and American Society of Testing and Materials (ASTM) Test Methods described in these specifications for putting green and sports turf root zones by an Approved Soil Testing Laboratory with A2LA Accreditation in these procedures.
1. The cost of all testing shall be borne by the Contractor. The Owner reserves the right to perform its own testing of all materials.
 2. All testing reports and recommendations shall be submitted to the Owner's Representative for review prior to use of or spreading of materials.
 3. Approved Soil Testing Laboratories:

A. McNitt & Seren Soil Testing, LLC
306 Ravendale Road
Pennsylvania Furnace, PA 16865
(610) 360-5985

Turf & Soil Diagnostics
35 King Street
Trumansburg, NY 14886
1-855-769-4231

- B. Amended Topsoil Testing and Analysis:
1. Sampling shall be taken in several locations within the stockpile. The outer 6 inches of the piles should be pulled back and a sampling tube (PVC is adequate) inserted into the pile. Withdraw the sample and place it in a large container, such as a 5-gallon pail. A minimum of 6 samples should be removed from different sections and levels in the pile. Once all the samples are taken, the composite sample should be spread on a tarp, mixed thoroughly, and split in half. Discard half. Split the remaining material in half, and discard half again. Continue doing

this until you have a one-gallon sized sample.

- a. Testing shall consist of fertility, particle size and organic matter analysis.
- b. Amended Topsoil analysis shall show recommendations for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish particular agricultural, horticultural, or sportsturf management objectives noted.
- c. All tests shall be performed in accordance with the current standards of the Association of Official Agricultural Chemists.
- d. All reports and fertility program recommendations shall be submitted to the Owner’s Representative for approval prior to spreading.
- e. Organic Matter Analysis (ASTM F1647, method A)
- f. Proctor Testing per ASTM D698 or D1557

C. Compaction Testing:

- 1. Provide compaction test results (ASTM D698) for the subgrade following rough grading procedures and on the amended topsoil following fine grading procedures to the Owner’s Representative for approval. Testing shall be conducted and paid for by the Contractor by a testing agency approved by the Owner’s Representative.
 - a. Obtain appropriate Proctor Test results as described above for the subsoil and amended topsoil mix.
 - b. Complete one (1) compaction test for every 15,000 sf of area within the athletic field limits. Final locations of testing shall be determined by the Owner’s Representative.

1.06 QUALITY ASSURANCE

- A. Work under this Section shall be completed by skilled workers who are completely familiar with the specific requirements and methods needed for the proper completion of the work of this Section.
- B. Experience: Natural Grass Athletic Field construction shall be performed by an experienced specialty firm, which shall have constructed at least ten (10) outdoor natural grass athletic fields of 30,000 s.f. or greater of the general type and installation process herein specified within the last 4-year period. Key staff and equipment operators must have a minimum of three (3) years of outdoor natural grass athletic field construction experience. All experience must have been from one company (either general contractor or the sub-contractor). Combining work to meet the experience criteria will not be allowed.
- C. All seed shall comply with all Federal, State and local laws and regulations requiring inspection for plant disease and insect control.

1.07 PRODUCT HANDLING

- A. Delivery and storage:
 - 1. Deliver all items to the job site in their original containers with all labels intact and legible at time of Owner’s Representative’s inspection.
 - 2. Immediately remove from the site all materials which are not true to name, and all materials which do not comply with the specified requirements.
 - 3. Use all means necessary to protect materials before, during and after installation, and to protect the work and materials of all other trades.

4. Repair and Replacement: in the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner’s Representative and at no additional cost to the Owner.
5. Contamination: Immediately remove from the site all materials that have been contaminated. In the case of contamination of stockpiled items, remove entire stockpile from site immediately.

1.08 JOB CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Owner’s Representative before spreading Amended Topsoil.

PART 2 - PRODUCTS

2.01 ATHLETIC FIELD CONSTRUCTION EQUIPMENT

- A. Tractors and other Vehicles:
 1. All vehicles trafficking the subgrade, amended topsoil, or finished athletic field shall be Low Ground Pressure (8 lbs per square inch – maximum) tracked vehicles or be equipped with special flotation tires designed to minimize compaction of the athletic profile and surface.
- B. Laser Grader:
 1. The finished athletic field amended topsoil shall be graded to the specified tolerances with a machine equivalent to Laser-Grader by P. Ronci Machine Company or LeeBoy 635B Motor Grade and meeting the following requirements:
 - a. Remote laser controlled, via the use of a GPS positioning survey system, hydraulically operated dual slope grading apparatus with self-correcting blade not exceeding 6 feet in width and dual angle sensors adequate to calculate the cross-slope of the blade.
 - b. The tolerance of the machine shall be able to grade to +/- 1/8” accuracy with processed material.
 - c. Maximum machine weight of 3300 lbs
 - d. Maximum ground tire compression of 550 lbs per tire
 2. Dozers and rear mounted box style graders will not be permitted.

2.02 AMENDED TOPSOIL

- A. Existing Topsoil stockpiled from on-site stripping shall be triple screened, amended and utilized for athletic field areas at a minimum depth of eighteen (18”) inches.
- B. The Contractor shall submit representative samples of Existing Topsoil that was stockpiled from on-site stripping, to a Soil Plant Testing Laboratory for Testing and Analysis. Refer to Section 1.02 MATERIALS TESTING. Testing of materials shall include proposed amendment materials. Soil analysis tests shall include recommendation for soil additives to correct soil deficiencies as necessary, and for additive to accomplish particular objectives noted.

- C. Amended Topsoil shall consist of the existing stripped and triple-screened topsoil, washed screened sand (if deemed a requirement by Soil Plant Testing Laboratory), and organic matter. Materials shall meet requirements set forth below:
1. Topsoil (if additional is required, although not anticipated due to the volume of available topsoil that will be generate on-site):
 - a. Topsoil shall be natural, fertile, friable loam or sandy loam typical of cultivated topsoils of the locality, containing not less than 3.5% or more than 8% by weight of decayed organic matter (humus), as determined by ASTM F-1647. Topsoil shall be taken from a well-drained, arable site, free of sub-soil, large stone, earth clods, sticks, stumps, clay lumps, roots or other objectionable extraneous matter or debris. Topsoil shall also be free of Quackgrass rhizomes, *Agropyron Repens*, and nut-like tubers of Nutgrass, *Cyperus Esculentus*, and all other primary noxious weeds. Topsoil shall not have a pH factor less than 6.0 or greater than 7.0. Topsoil shall not be delivered or used for planting while in frozen or muddy condition. Topsoil shall conform to particle size distribution with a maximum three eights (3/8”) inches largest dimension, as determined by pipette method in compliance with ASTM F-1632:

Sand:	40 – 60%
Silt:	30 – 40%
Clay:	5 – 20%
 2. Washed Screened Sand (if deemed required by Soil Plant Testing Laboratory):
 - a. Washed Screened Sand for Amended Topsoil shall be concrete sand meeting the requirements of ASTM C-33 with the following addenda: The sand shall have a fineness modulus of 2.5 to 3.2 and a coefficient of uniformity of less than 4.
 3. Organic Matter (Compost):
 - a. Organic Matter for Amended Topsoil shall be STA Certified Compost, meeting the requirements of *Delaware Erosion and Sediment Control Handbook*, Appendix A-3, “Compost Material Properties”. Verification of the STA Certified Compost shall be submitted to the Landscape Architect/Civil Engineer for approvals prior to incorporation into the existing topsoil.
 - b. Organic Matter shall be added in sufficient quantity to bring the organic content of the Amended Topsoil to 6-8%.

2.03 LIME

- A. Lime shall be an approved agricultural limestone containing no less than fifty percent (50%) of the total carbonates and twenty-five percent (25%) total magnesium with a neutralizing value of at least one hundred percent (100%). The material shall be ground to such a fineness that forty percent (40%) will pass through a number 100 U.S. Standard Sieve, and ninety-eight percent (98%) will pass through a number 20 U.S. Standard Sieve. The lime shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, un-opened containers, each bearing the manufacturer’s guaranteed analysis – submit to the Owner’s Representative for approval.

Any lime, which becomes caked or otherwise damaged making it unsuitable, will be rejected.

1. Soil pH: The amount of lime or sulfur required to change pH should be based on a soil test. Spread ground limestone as recommended by the soil test over the athletic field surface. Do not exceed one hundred fifty (150) pounds of lime per one thousand (1,000) square feet. When using pelletized limestone materials, apply at the same rate as for ground limestone for rapid pH change and at one half (1/2) the rate for normal applications. Do not apply sulfur during mid-summer stress period and do not exceed five (5) pounds per one thousand (1,000) square feet per year. On sandy soils, apply sulfur as a split application.

2.04 FERTILIZER

- A. All fertilizer products shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original un-opened containers, each bearing the manufacturer's guaranteed analysis – submit to the Owner's Representative for approval. Any product, which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.
- B. Contractor shall have the amended topsoil mix tested for soil fertility by an approved soil testing laboratory (at the Contractor's expense). A complete fertilization program for the installation maintenance period shall be recommended by the soil-testing laboratory for approval by the Owner's Representative.
- C. Continue with the application of recommended fertilization program until all turf areas are in acceptable condition and are approved in writing by the Owner's Representative.
- D. Costs for the fertilization program shall be borne by the Contractor until final acceptance by the Owner's Representative.
- E. Prior to seeding, apply fertilizer supplements and a commercial turfgrass starter fertilizer at a rate determined by the approved soil testing laboratory.

2.05 SUPERPHOSPHATE

- A. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, and containing not less than twenty percent (20%) available phosphoric acid. The superphosphate shall be delivered to the site in the original, un-opened containers each bearing the manufacturer's guaranteed analysis – submit to the Owner's Representative for approval. Any superphosphate, which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.06 WATER

- A. Owner provided water shall not be utilized for anything other than this project and shall not be used for purposes unrelated to the construction of the field.
- B. Water for settling the installed amended topsoil, establishing and irrigating the proposed field will be in the form of hoses and/or temporary irrigation system provided at no additional cost to the Owner.

2.07 HERBICIDES, PESTICIDES AND FUNGICIDES

- A. Herbicides, pesticides and fungicides may be used subject to the approval of the Owner and the Owner's Representative, if they are handled and applied by a state licensed operator.

2.08 SEED

- A. Grass seed shall be clean, new crop seed, composed of a mixture of varieties, mixed in proportion by weight and tested for minimum percentages of purity and germination. Submit proposed mixture to the Owner’s Representative for approval.
- B. Athletic Field Seed Mix:
 - 1. Seed shall be fresh, clean seed from the latest year’s crop. The seed shall meet requirements of DNREC’s permanent Seed Mix #7 of the *Delaware Erosion & Sediment Control Handbook*.
 - 2. The seed mix shall consist of Tall Fescue (150 lb/Ac), Kentucky Bluegrass (three cultivars at 20 lb/Ac), and Perennial Ryegrass (20 lb/Ac).
- C. Hydroseed Mix:
 - 1. All work will be carried out by an approved spraying machine specifically used for this work. The Contractor shall submit to the Owner’s Representative for approval, prior to the start of work, a certified statement as to number of pounds of fertilizer, amount and types of grass seed (shall match Athletic Field Seed Mix), and processed fiber, per one hundred (100) gallons of water.
 - 2. Hydromulch: Shall be Terra-Sorb GB, or an approved equal. Add Terra-Sorb to the hydroseed tank at the amount of 60 pounds per acre.

PART 3 - EXECUTION

3.01 SCREENED TOPSOIL

- A. All topsoil that was stripped and stockpiled shall be triple-screened to a maximum stone size of 3/8 in.

3.02 SUBGRADE VERIFICATION

- A. The slope of the subgrade shall conform to or be slightly greater than the general slope of the finish grade. Confirm that the subgrade slopes without settlement or pockets promoting the collection of water.
- B. Provide subgrade compaction tests. Subgrade compaction results shall not exceed 93% of maximum compaction as performed in laboratory testing. If requested by the Owner’s Representative, proof-roll the subgrade in the presence of the Owner’s Representative.
- C. Move no heavy objects over the subgrade after preparation.
- D. Subsequent to completion of the subgrade preparation by General Contractor, the General Contractor and Athletic Field Contractor shall verify that the subgrade is with the specified slope tolerances and is not over-compacted. The General Contractor shall provide written verification to the Owner and Owner’s Representative. Commencement of work by the Athletic Field Contractor prior to written verification constitutes acknowledgement that the subgrade meets the specified grade and compaction tolerances.

3.03 AMENDED TOPSOIL INSTALLATION

- A. Notify Owner’s Representative 48 hours prior to spreading of approved Amended Topsoil for approval of subsurface grades. The slope of the subgrade shall conform or be slightly greater than the general slope of the finish grade. Confirm that subgrade slopes to drainage system without settlement or pockets promoting collection of water.

- B. Loosen and mix subgrade material four inches to six inches (4"-6") deep. Remove stones over two (2") inches, sticks and rubbish. Move no heavy objects over athletic field area after preparing subgrade surface.
- C. Apply the Amended Topsoil at athletic fields over the complete subgrade to the depths and finished grades shown on the drawings. Material shall be installed in a moist condition with approved field construction equipment and shall be fine graded with a laser controlled hydraulically operated grading machine with a tolerance of ¼ inch in 25 feet in either direction plus or minus of elevations shown on the drawings when compacted. Contractor shall move the material from the approved stockpiles in such a manner that contaminated materials are not tracked onto the field from tracks or tires. Any contamination or over compacted conditions will require immediate action by the Contractor to satisfy the intent of the specification.
- D. Compaction of soil: Operate the irrigation system one full cycle. Fill in low spots to finish grade with Amended Topsoil as appropriate and water thoroughly. The process shall be repeated as necessary to bring the field to finish grade within the tolerances described. Finish grades shall be verified by survey instruments. If a light roller is used to obtain field grade, the surface shall be scarified before laying of sod. Field compaction shall not exceed the bulk density as performed in laboratory testing.
- E. Provide the Owner's Representative with a laser level topological survey using a 10-foot grid pattern for review. By seeding and/or sodding prior to receiving the written approval of the Owner's Representative, the Contractor assumes acceptance of the finish grade condition and the responsibility to repair deficiencies resulting from incorrect grades at his sole cost. Obtain the written approval of the Owner's Representative for finish grade of athletic field surfaces prior to seeding and/or sodding operations.
- F. Soil pH: Spread ground limestone as recommended by the soil testing laboratory evenly over the athletic field surface. Do not exceed one hundred (100) pounds of lime per one thousand (1,000) square feet. The rate is based on an incorporation depth of four (4") inches. When using pelleted limestone materials, apply at the same rate as for ground limestone for rapid pH change and at one half (1/2) the rate for normal applications.
- G. Prior to seeding, apply a commercial turfgrass starter fertilizer at a rate determined by the Approved Soil Testing Laboratory.

3.04 FERTILIZING

- A. Athletic Field Contractor to have Amended Topsoil Mix tested for soil fertility by the Approved Soil Testing Laboratory, and a complete fertilization program will be recommended by the testing laboratory for the installation maintenance period and be reviewed and approved by the Owner and Owner's Representative.
- B. Continue with application of recommended fertilization program until all turf areas are in acceptable condition and are approved in writing by the Owner's Representative.
- C. The cost of the fertilization program shall be borne by the Athletic Field Contractor until final acceptance by the Owner's Representative.

3.05 SEEDING

- A. Schedule for Seeding: Sow grass seed between March 1 and April 30, or between August 1 and October 31, except as otherwise approved in writing by the Landscape Architect.

- B. If seeding out of season as described above, the Contractor is still obligated by all conditions and responsibilities described under 3.06 TURF MAINTENANCE AND INSPECTION until final acceptance of the athletic field.
- C. Natural Grass Athletic Field as indicated in the Drawings shall be double slice seeded. The second seed application shall be installed perpendicular to the first slice seed application.
- D. Before seed is sown, scarify soil and rake until surface is smoother, friable, and of uniformly fine texture. Slive seed evenly at Seed Mix’s approved rate, applying seed in two half rate applications at 45-degree angles, lightly rake, roll with two hundred (200) pound roller and water with fine spray. Method of seeding may be varied at discretion of Contractor with the written approval of the Landscape Architect. It is the Contractor’s responsibility to establish a smooth, uniform turf composed of approved grasses.
- E. Following slice seeding operations of the Natural Grass Athletic Field, hydroseed on top of slice seed.

3.06 TURF MAINTENANCE AND INSPECTION

- A. Maintenance of the athletic field turfgrass shall begin immediately after seeding operations, and generally consist of watering, weeding, mowing and edging, fertilization, aerification, reseeding, disease and insect pest control, repair of all erosion, and any other procedure consistent with good horticultural practice, necessary to insure normal, vigorous and healthy turfgrass growth.
- B. Maintenance shall also include all temporary protection fences, barriers, signs and all other work incidental to proper maintenance.
- C. The Contractor shall be responsible for maintenance to establish a uniform stand of the approved grasses until acceptance. After seed has germinated, all areas and parts of areas shall be re-seeded, repeatedly, until all areas are covered with a satisfactory growth of grass.
- D. At the time of the first cutting, mow turf not less than one (1") inch high with sharp reel type mowing units. Turf shall be maintained at one inch (1") high. Do not remove more than one third (1/3) of the grass blade during a mowing which should result in no visible clippings left after a mowing.
 - 1. The athletic field will not be considered acceptable, and the Athletic Field Contractor’s maintenance responsibilities will continue, until the entire athletic field exhibits uniform, healthy and vigorous turfgrass growth. A minimum of ten (10) mowings must be completed before final acceptance.
 - 2. The machine used to mow the field shall have a deck no larger than 72” and utilize low ground pressure tires to minimize compaction at the field.
- E. Watering: Athletic Field Contractor shall provide at his cost daily, and if necessary continuous watering of all grass areas during a normal 8 hour working day. The growing medium shall be maintained in a continuous moist condition, satisfactory for good germination and growth of grass, as specified until acceptance. The Athletic Field Contractor is responsible for providing all equipment, hoses, etc. for watering throughout the project and until final acceptance of athletic field turf by the Landscape Architect.
- F. Full and complete written records for the maintenance of the athletic fields are to be furnished to the Owner, by the Contractor at least ten (10) days prior to the end of the contractual maintenance period, to familiarize him with the maintenance requirements for proper care and development of the turfgrass.

3.07 INSPECTION AND ACCEPTANCE

Summit Campus Middle and High School		Appoquinimink School District
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- A. The Owner’s Representative shall inspect the athletic field turf for acceptance upon written request by the Athletic Field Contractor. The request shall be received at least ten (10) days before the anticipated date of inspection.
- B. Final acceptance will not be granted until all seeded areas are in satisfactory condition.
- C. If the turfgrass is in satisfactory condition, the Athletic Field Contractor's care and maintenance responsibilities will end. If the grass stand is unsatisfactory, the Athletic Field Contractor's maintenance responsibilities shall continue until an acceptable stand of grass is achieved. The Athletic Field Contractor shall fertilize the turf and/or treat pests if, in the Owner’s Representative's opinion, it is needed in order to achieve an acceptable athletic field.

3.08 POST CONSTRUCTION MAINTENANCE PROGRAM

- A. Once the Owner accepts the athletic field seeded areas per section 3.07, a one (1) year post construction maintenance program shall commence. The contractor shall provide a formal written plan to the owner’s representative prior to commencement of the work. The contractor shall provide the Owner a minimum of 48 hours notice prior to performing any work.
- B. General Contractor shall engage a professional landscape maintenance company to perform the following work
- C. Growing Season:
 - 1. Late April/Early May
 - a. Soil test for development of annual fertilizer program
 - b. Core aeration (3/4” equivalent to Toro ProCore) 4-5” depth remove and dispose of cores)
 - c. Overseed (injection) 70/20/10 tall fescue/rye/blue 4 x lbs. /1,000 SF
 - d. Topdress with 2mm sand topdressing
 - e. Fertilize (macros and micronutrients) per soil test
 - f. Apply granular lime per soil test
 - g. Apply herbicide
 - i Apply pre-emergent crabgrass preventer at manufacturer’s recommended rates in high use areas.
 - 2. June:
 - a. Overseed (broadcast) 70/20/10 tall fescue/rye/blue 4 x lbs. /1,000 SF
 - b. Fertilize (macros and micronutrients) per soil test
 - c. Apply Liquid Organic Fertilizer – Holganix 66 GC liquid compost mix (or similar) @7-14 oz//1,000 SF
 - d. Apply BioPro H30 wetting agent (or similar) at manufacturer’s recommended rates
 - 3. July:
 - a. Apply liquid herbicide
 - i Apply post-emergent crabgrass control at manufacturer’s recommended rates as needed.
 - ii Apply post-emergent broadleaf control at manufacturer’s recommended rates as needed
 - iii Include crop oil surfactant to increase efficacy
 - b. Apply granular Grub Control at manufacturer’s recommended rates
 - c. Fertilize (macro and micronutrients) per soil test

4. Mid-August/Early September
 - a. Slice seed with 70/20/10 tall fescue/rye/blue 4 x lbs. /1,000 SF
 - b. Core aeration (3/4" similar to Toro ProCore) 4-5" depth (remove and dispose of cores)
 - c. Topdress with 2mm sand topdressing
 - d. Fertilize (macro and micronutrients) per soil test
 - e. Apply Liquid Organic Fertilizer – Holganix 66GC (or similar) liquid compost mix @ 7-14 oz./1,000 SF
 - f. Apply Bio Pro H30 (or similar) liquid compost mix @ 7-14 oz./1,000 SF
5. Late October/Early November:
 - a. Slice seed (2x at 90 degree angle) with 70/20/10 tall fescue/rye/blue 4 x lbs. /1,000 SF
 - b. Fertilize (macro and micronutrients) per soil test

3.09 CLEAN UP

- A. Absolutely no debris may be left on the site. Excavated material shall be removed as directed. Repair any damage to site or structures to restore them to their original condition, as directed by the Owner’s Representative, at no cost to the Owner.

END OF SECTION

SECTION 32 18 23.29
INFILLED SYNTHETIC TURF SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 010000 - GENERAL REQUIREMENTS, which are hereby, made a Landscape Architect / Civil Engineer of this Section of the Specifications.
- B. It is the intent of this Section to specify an Infilled Synthetic Turf System that provides high-quality playing surfaces for high school football, soccer, field hockey, lacrosse, and other multi-purpose uses. The finished surfaces shall be immediately firm, consistent and stable while providing long-term durability, safety and shock attenuation. The Infilled Synthetic Turf System Vendor's attention is called to the testing requirements related to G-Max rating per ASTM F355-A. A G-Max rating of less than 90 or in excess of 150 and a HIC Critical Fall Height of less than 1.4-meters at any time from acceptance through the end of the Warranty Period is unacceptable.
1. It should be noted that trapped fibers in seams and/or beneath carpet fibers within the general carpet will not be accepted. The Contractor shall provide the appropriate amount of time to infill the carpet while brushing up fibers and laying infill in thin lifts to ensure all fibers are upright to the surface and are not caught beneath infill or other fibers.
 2. A Field Line Layout Drawing is provided as part of the Construction Documents. It is the responsibility of the Infilled Synthetic Turf Vendor and/or Installer (preparing the shop drawings) to review the Field Line Layout prior to submitting the turf shop drawings for review. The Field Line Layout will provide field line and logo dimensions, colors, and order of priority for when field lines from different sports intersect (note it is not by sport, but by importance of the line). If it appears that the Field Line Layout was not reviewed prior to submitting the shop drawings, they will be rejected without review until the shop drawings are coordinated with the Field Line Layout.
- C. Note the requirements within regarding PFAS and provide documentation required.
- D. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- E. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DEFINITIONS

- A. General Contractor: the entity who holds the project contract with the Owner. The General Contractor is responsible for all coordination of the work within this specification. If problems arise during construction, the General Contractor will be responsible for construction and monetary implications in regards to the Project Contract.

- B. Base Contractor: the site contractor or specialty athletic field contractor meeting the listed experience criteria and performing the subgrade preparation directly below and around the limits of the turf field area; overseeing the installation of the concrete turf anchor at the perimeter of the field; installing all geotextile fabric and drainage in and around the field; installing the base stone and finishing stone materials within the field area; and providing a finish grade on the finishing stone layer to a tolerance of 1/8" in 10'.
- C. Infilled Synthetic Turf Vendor: the entity that procures and is responsible for the installation of all Infilled Synthetic Turf System components. The Infilled Synthetic Turf Vendor also provides and services the warranty.
- D. Infilled Synthetic Turf Installer: a specialty athletic synthetic turf installation contractor meeting the listed experience criteria. This contractor will be responsible for performing the installation of the synthetic turf underlayment, carpet and components.
 - 1. If the Infilled Synthetic Turf Installer is not a direct employee of the Infilled Synthetic Turf Vendor, it is assumed that the Infilled Synthetic Turf Installer is under contract to the Infilled Synthetic Turf Vendor and that the Infilled Synthetic Turf Vendor is responsible for all work undertaken by the Infilled Synthetic Turf Installer.
- E. Independent Testing Company: a specialty testing company focusing on testing of athletic surfaces. Acceptable companies include, but may not be limited to:
 - 1. Firefly Sports Testing – East, Jeff Gentile, 603-715-5453
 - 2. Labosport USA – Thierry Levy, 706-529-9474
 - 3. Sports Labs North America – Kieran O'Donnell, 423-541-5526

1.03 WORK INCLUDED

- A. For a full description refer to PART 3 - EXECUTION of this Specification. The following is brief summary of the proposed work:
 - 1. Furnish and install free draining base and drainage materials as specified within.
 - 2. Provide all inspections and certifications of subgrade and subsequent layers as specified within.
 - 3. Provide drainage testing by means of a Dual Ring Infiltrometer (DRI) as specified within.
 - 4. Install synthetic turf system and underlayment per specifications and drawings
 - 5. All testing requirements on finished surface
 - 6. Cleanup
 - 7. All warranty, training, and closeout requirements

1.04 RELATED WORK UNDER OTHER SECTIONS

- A. Carefully examine all of the Contract Documents for requirements that affect the work in this section. Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1. Site Preparation
2. Cast-in-Place Concrete
3. Athletic Ball Netting System
4. Earthwork
5. Chain Link Fence
6. Resilient Track Surface
7. Athletic Storm Drainage System

1.05 REFERENCES

A. References herein to any technical society, organization, group or body are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable:

1. American Society for Testing and Materials (ASTM).
2. American Sports Builders Association (ASBA).
3. Consumer Products Safety Commission (CPSC).
4. Synthetic Turf Council (STC).
5. Delaware Interscholastic Athletic Association (DIAA)

1.06 QUALITY CONTROL

A. Experience:

1. Base Contractor: Shall have successfully (quality and timely) installed Free Draining Stone Base and drainage systems for at least nine (9) outdoor synthetic turf athletic field bases of 50,000 s.f. or greater of the type and installation process herein specified within the last 3-year period.
 - a. The Base Contractor’s Site Foreman shall have installed at least five (5) outdoor synthetic turf athletic field bases and drainage systems in the last 3-year period.
2. Infilled Synthetic Turf Vendor: Shall have successfully (quality and timely) supplied at least forty (40) outdoor athletic field systems of 50,000 s.f. or greater of similar type and installation process herein specified within the last 3-year period.
 - a. All installation operations shall occur under the full-time on-site direction and supervision of a qualified technical supervisor directly employed by the Infilled Synthetic Turf Vendor. Installation supervisors shall have a minimum of five (5) years experience in the installation of Infilled Synthetic Turf Systems and shall have supervised the installation of at least ten (10) outdoor athletic field systems of 50,000 s.f. or greater of similar type and installation process herein specified within the last 3-year period.
3. Infilled Synthetic Turf Installer: Shall have successfully (quality and timely) laid

at least fifteen (15) outdoor athletic field systems of 50,000 s.f. or greater of similar type and installation process herein specified within the last 3-year period. References shall be provided with bids so that the installer's experience record can be verified.

- a. All installation operations shall occur under the full-time on-site direction and supervision of a qualified technical supervisor directly employed by the Infilled Synthetic Turf Vendor.
- b. All installation operations shall be performed by personnel fully familiar with the materials and their application. Installation Foreman shall have installed at least ten (10) outdoor athletic field systems of 50,000 s.f. or greater of similar type and installation process herein specified within the last 3-year period.

B. Source Limitations:

1. Obtain Infilled Synthetic Turf System including tufted synthetic turf yarn and carpet backings from a single Tufted Synthetic Turf Manufacturer. Provide additional system components including anchoring materials, seaming products, binders and adhesives, resilient underlayment and infill materials meeting the criteria of this Specification Section from single sources.

C. Inspection and Acceptance:

1. All inspections and acceptance shall be provided in writing to the Landscape Architect / Civil Engineer.
 - a. Subgrade - Both the Base Contractor and the Infilled Synthetic Turf Installer (if the Turf Installer is not a direct employee of the Turf Vendor, then a representative of the Turf Vendor shall also be present) shall inspect the subgrade to verify their acceptance of installation and condition. Commencement of subsequent installation in a given work area indicates acceptance of underlying substrates and systems. Refer to Section 31 00 00, EARTHWORK, for requirements of subgrade preparation.
 - b. Drainage System - Both the Base Contractor and the Infilled Synthetic Turf Installer (if the Turf Installer is not a direct employee of the Turf Vendor, then a representative of the Turf Vendor shall also be present) shall inspect the drainage system to verify their acceptance of installation and condition. Commencement of subsequent installation in a given work area indicates acceptance of underlying substrates and systems.
 - c. Free Draining Base Stone - Both the Base Contractor and the Infilled Synthetic Turf Installer (if the Turf Installer is not a direct employee of the Turf Vendor, then a representative of the Turf Vendor shall also be present) shall inspect the free draining base stone layer to verify their acceptance of installation and condition. Commencement of subsequent installation in a given work area indicates acceptance of underlying substrates and systems.
 - d. Free Draining Finishing Stone – Both the Base Contractor and the Infilled Synthetic Turf Installer (if the Turf Installer is not a direct

employee of the Turf Vendor, then a representative of the Turf Vendor shall also be present) shall inspect the free draining finishing stone layer to verify his acceptance of installation and condition. Commencement of subsequent installation in a given work area indicates acceptance of underlying substrates and systems.

e. The Base Contractor and Infilled Synthetic Turf Vendor/Installer and associated subcontractors shall comply with the drawings, specifically notes regarding sequencing, existing condition investigations and proposed grade tolerances.

2. The General Contractor and associated subcontractors shall comply with the drawings, specifically notes regarding sequencing, existing condition investigations and proposed grade tolerances.

D. Planarity and Grade:

1. Free Draining Finishing Stone - Deviation in planarity shall not exceed 1/8" beneath a 10' straightedge. Deviation from a straight grade between levels on drawings shall not exceed 1/8". Refer to testing requirements in Part 3 of this specification.

E. Protection: Heavy equipment or vehicles (with the exception of tracked or low ground pressure (LGP) vehicles) of any kind should not be allowed on the athletic field area subsequent to the completion of the athletic field base and drainage system.

F. Restoration of Damage: The Infilled Synthetic Turf Installer shall exercise care in the execution of his work and avoid damage or defacement of the adjacent or surrounding areas by using suitable protective means. Damage or defacement that occurs shall be remedied at the Infilled Synthetic Turf Vendor's cost to the satisfaction of the Owner.

1.07 SUBMITTALS

A. Submit the following in accordance with the Conditions of the Contract, or prior to issuance of a contract if requested by the Landscape Architect / Civil Engineer.

1. Base Contractor:

a. Base Contractor's Site Forman's resume showing compliance with QUALITY CONTROL – Experience section of this specification with contact names, addresses and telephone numbers to enable such data to be validated prior to the award of the project.

2. Infilled Synthetic Turf Vendor:

a. Submit a signed statement from the Infilled Synthetic Turf Vendor that the Drawings and Specifications have been reviewed by a qualified representative of the Infilled Synthetic Turf Vendor and all major materials suppliers, and that they are in agreement that the materials and installation methods to be used for the Drainage Base and Infilled Synthetic Turf System are proper and adequate for use as a high quality

- playing surface for multi-purpose collegiate athletic field use.
- b. The Vendor's recent reference list showing compliance with QUALITY CONTROL – Experience section of this specification with contact name, address and telephone number to enable such data to be validated.
 - c. Infilled Synthetic Turf Vendor's Installation Supervisor's resume showing compliance with QUALITY CONTROL – Experience section of this specification with contact names, addresses and telephone numbers to enable such data to be validated.
 - d. Infilled Synthetic Turf System Installer's Foreman's showing compliance with QUALITY CONTROL – Experience section of this specification with contact names, addresses and telephone numbers to enable such data to be validated.
 - e. Provide a sample written 8-year labor and materials warranty from the Infilled Synthetic Turf Vendor.
 - f. Provide a sample written Third Party Warranty.
 - g. A signed letter on company letterhead holding the Owner, Landscape Architect / Civil Engineer and all other project consultants harmless for any violation of patent rights or infringement.
 - h. Sample warranty for resilient underlayment (pad).
 - i. Cut Sheets for all materials required under this Section including third party ASTM certified lab reports.
 - j. Material Safety Data Sheets (MSDS) for all materials required under this Section.
 - k. **HEAVY METALS:** The Infilled Synthetic Turf Vendor shall submit a signed letter, on company letterhead, stating the company's specific manufacturing and procurement practices that address Health and Human Safety concerns. The letter shall certify, through the independent testing of all Infilled Synthetic Turf System components installed as part of the Project, that their system's lead and other heavy metal content complies with the United States Consumer Product Safety Commission's (CPSC) most stringent requirement for lead content in children's toys (below 100 ppm), is safe for the environment and for use by people of all ages. Copies of the testing reports shall also be provided in conjunction with the certification. Installation of the field shall not commence until the written certification is received. Adjustments to the project schedule to accommodate testing laboratory schedules will not be granted.
 - l. **PFAS:** The Infilled Synthetic Turf Vendor shall submit a signed letter, on company letterhead, stating that the Vendor and their suppliers do not use PFAS (as defined in EPA Method 537 and California Proposition 65) in or as part of their manufacturing process for their turf fibers, primary backings, and urethane coatings or the assembly of any components of the system or system as a whole. PFAS must be non-detectable at analytical detection limits that are suitable to meet state regulatory standards for solids as defined below. Alternatively, PFAS must be non-detectable at analytical detection limits that are suitable to meet state regulatory standards for liquid as defined below using a leaching test (e.g., EPA Method 1312). If an Infilled Synthetic Turf Vendor is unable to provide this information, they will be rejected for not meeting this requirement.

Required detection limits - solids:

PFDA: 0.03 ug/kg
 PFHpA: 0.05 ug/kg
 PFHxS: 0.03 ug/kg
 PFNA: 0.03 ug/kg
 PFOS: 0.2 ug/kg
 PFOA: 0.07 ug/kg

Required detection limits – liquid:

PFDA: 0.003 ug/L
 PFHpA: 0.003 ug/L
 PFHxS: 0.003 ug/L
 PFNA: 0.003 ug/L
 PFOS: 0.003 ug/L
 PFOA: 0.003 ug/L

3. Shop Drawings:

- a. The Base Contractor and the Infilled Synthetic Turf Vendor shall coordinate and provide details that illustrate the scope of work, including but not limited to materials, cross sections, subsurface and penetration details.
- b. The Infilled Synthetic Turf Vendor shall provide an underlayment and seaming plan at 1"=20'-0". The seaming plan shall include all tufted lines.
- c. The Infilled Synthetic Turf Vendor shall supply shop drawings (including details) at an approved scale indicated method of attaching synthetic turf carpet to existing concrete turf anchor.
- d. The Infilled Synthetic Turf Vendor shall provide a striping plan at 1" = 20'-0" which demonstrates compliance with applicable requirements for the layouts shown on the Drawings and in these Specifications. The striping plan shall indicate all tufted and inlaid field markings.

4. Product Samples and Information (Infilled Synthetic Turf Vendor to submit):

- a. Provide color samples of polyethylene slit film fiber for approval.
- b. Provide a minimum 12-inch by 12-inch sample of slit film polyethylene fiber carpet.
- c. Provide a 12" x 12" sample of Resilient Underlayment
- d. Provide a letter describing the proposed materials and method(s) of attachment for the carpet panels.
- e. Provide sieve analysis of infill materials for approval.
- f. Provide a 1-quart sample of the SBR rubber infill mix at the Landscape Architect / Civil Engineer's approved mix ratio.
- g. Provide information regarding future requirements for painting of field surface.
- h. Provide technical specifications on all installation equipment to be utilized.

5. Letter of certification that the existing synthetic turf carpet has been

recycled/repurposed and all associated Chain of Custody documentation.

6. Delivery slips for all Infilled Synthetic Turf System materials delivered to the site.
 - a. Note that delivery slips for new infill materials shall be supplied to the Landscape Architect/ Civil Engineer to confirm the ration of infill mixture installed within the field.
7. Provide an as-built field layout drawing prior to infilling with verification and certification that the field layouts meet the requirements of NCAA and the project documents.
8. Provide Field Maintenance Training and a comprehensive written Maintenance Manual to the Owner.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products in exact accordance with the Manufacturer's requirements and specifications.
- B. Products delivered to the site that are not in compliance with the requirements of this Section shall be removed from the site immediately at no cost to the Owner.

1.09 PROJECT CONDITIONS

- A. Weather Limitations: No part of the construction shall be conducted during a rainfall or when rainfall is imminent, or unless both ambient and materials temperatures are at least 40 degrees F and rising.
- B. After a rainfall, sufficient time shall be given to allow surfaces and infill materials to dry before resuming work. Surfaces and materials shall be dry, as well as clean. Adhesives should not be applied within 12 hours after rainfall, or when rainfall is forecasted.
- C. Do not apply Infilled Synthetic Turf System materials or components over wet, frozen, or muddy base.

1.10 WARRANTY

- A. Warranty: The Infilled Synthetic Turf Vendor shall guarantee all self manufactured and procured Infilled Synthetic Turf System materials and workmanship against damage by climatic conditions or proper and normal use (including the use of cleats) for a minimum period of eight (8) years from the official date of Substantial Completion. In addition, the Infilled Synthetic Turf Vendor shall guarantee all self manufactured and procured materials and/or workmanship including such defects as premature decrease in infill height, premature decrease in pile height or weight (stipulated as more than 10% decrease), UV degradation, splitting of fiber, fading, seam rupture, dislodgement, inadequate drainage or

inadequate air transmission. The guarantee shall be in writing and shall be signed by the Infilled Synthetic Turf Vendor stating that any defects, including the need to remove and replace self manufactured and/or procured materials will be repaired at no cost to the Owner within 7 days written notice of the Owner.

- B. Provide the manufacturer’s standard Third Party Insured Warranty. The Owner shall be named as an additional insured party.

1.11 PERFORMANCE TESTING ON FINAL SURFACE

- A. Performance Testing by an Independent Testing Company as specified within will be completed and the results verified as acceptable prior to substantial completion.

- 1. Drainage Testing (at each field):

- a. Upon completion of fine grading, complete a Dual Ring Infiltrometer Testing (ASTM D3385-9), (or other pre-approved method) by an Independent Testing Company coordinated and paid for by the Contractor. Five (5) tests per field shall be performed in locations determined by the Landscape Architect/Civil Engineer and/or Owner. Each test location shall have a permeability rate in excess of ten (10) inches per hour.
- b. If preliminary results in the field do not yield ten (10) inches per hour, the Landscape Architect/Civil Engineer and/or Owner may ask for additional locations to be tested. The Base Contractor and the Infilled Synthetic Turf Vendor shall provide written verification to the Landscape Architect/Civil Engineer that that the base and subsurface drainage system are functioning properly. Commencement of subsequent work prior to written verification constitutes acknowledgement that the systems are functioning properly.

- 2. GMAX (at each field): The Infilled Synthetic Turf System Vendor shall have G-Max testing performed by an approved and certified Independent Testing Company prior to requesting Substantial Completion. Testing shall consist of shock attenuation per ASTM F-355-A and F-1936 current edition and shall include the depth of infill as the test location as well as the temperature on the day of testing. The Owner and Landscape Architect/Civil Engineer shall be provided with copies of all testing.

- a. Testing locations shall be performed in accordance with ASTM Test Method F-1936 current edition. Tests shall also be taken at four (4) random spots. Locations to be selected by the Landscape Architect/Civil Engineer or Owner.
- b. At no time shall the G-Max be less than 85 nor exceed 150 at any one point of the field.
- c. In cases where the result of a test falls outside the specified values, additional tests shall be taken in 10-foot increments in four (4) opposite directions (north, south, east and west) from the failing test point and each subsequent failing test point until all tests fall within the specified values. The failing area shall be marked off, repaired and retested by the Infilled Synthetic Turf System Vendor until all tests fall within the specified values.

- d. G-Max testing during the remainder of the warranty period will be performed by and at the discretion of the Owner. Results of these tests will be provided to the Base Contractor and Infilled Synthetic Turf Vendor, if specifically requested.
 - e. If any tests fall within 5% of the maximum specified value, the Owner, at his discretion may require one additional set of tests at any time during the calendar year to be paid for by the Infilled Synthetic Turf Vendor.
3. HIC Testing (at each field): Testing shall be in accordance with EN-1177 and critical fall height shall not be less than 1.4-meters.
 4. Artificial Athlete (at each field): Testing shall be in accordance with EN-14808/14809 and shall be completed in 6 locations over the field area. Vertical deformation shall be 4-11 mm, shock absorption shall be 55-70%, and energy restitution 25-50%.
 5. Infill Depth (at each field): Infill depth testing by means of an infill depth gauge capable of measuring 0-2 inches per ASTM WK51663 using a Constant Ground Pressure 3-Prong Gauge. A minimum of 40 test locations shall be taken at random and documented in the test results provided to the Landscape Architect / Civil Engineer and Owner.
 - a. If the results of the depth gauge show the infill height to be on average lower than the depth specified, additional infill will be added to meet the specification and the field will be re-tested to show compliance.

1.12 PATENT RIGHTS AND INFRINGEMENT

- A. There are various established performance criteria throughout this specification and request for products and services. There may exist patent coverage for some means and methods of achieving those performance criteria. Bidders are responsible for ascertaining that means and methods of the products and services that they are providing are not being provided in violation of any such patent rights. Bidder's responsibilities are as follows:
 1. To hold harmless, the Owner, the Landscape Architect / Civil Engineer and all Project Consultants, as to any violation to include dollar amounts that could be owed as a result of damages for infringement including potential treble damages as provided for under U.S. Patent Law.
 2. Any and all costs that the Owner, the Landscape Architect / Civil Engineer and all Project Consultants would incur in replacing materials and services which are determined to infringe patent rights.
 3. All administrative, legal and other costs that would be incurred as a result of an infringement.
- B. If any product or services proposed to be provided by the Bidder are known by the Bidder to be subject to any existing claims of infringement, Bidder shall notify the Owner and the Landscape Architect / Civil Engineer of such claim and provide evidence of financial ability to perform on the above hold-harmless requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. This specification covers the installation of a new outdoor multi-purpose Infilled Synthetic Turf System comprised of tufted synthetic turf with an infill mixture (as specified herein) filled into the pile with a resilient underlayment (as specified herein) for added performance and player safety. The installed system after infilling shall have a permeability rate in excess of ten (10) inches per hour. The tufted synthetic turf is comprised of polyethylene parallel slit film fibers tufted into a coated/backed carpet as specified herein and meeting F.D. Doc FF1-70 and ASTM D-2859 flammability requirements, with an abrasion index of less than 25 per ASTM F1015 and meeting the following values for Static Coefficient of Friction per ASTM F1551.

- | | | |
|----|------------------------------|--------------|
| 1. | Dry Surface Static Friction | 1.06 minimum |
| 2. | Dry Surface Sliding Friction | 0.96 minimum |
| 3. | Wet Surface Static Friction | 1.00 minimum |
| 4. | Wet Surface Sliding Friction | 0.83 minimum |

2.02 FREE DRAINING INFILLED SYNTHETIC TURF FIELD BASE AND DRAINAGE MATERIALS

A. Geotextile Fabric

1. Shall be a needle-punched woven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Fabric shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.
2. Geotextile Fabric - Shall be a non-woven product equivalent to Mirafi 140N as manufactured by Ten Cate and as specified in Earthwork - 31 20 00.

B. Free Draining Base Stone

1. Shall be double washed durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quantity of thin, flat, elongated or other objectionable pieces. A detrimental quantity will be considered as any amount in excess of 15% of the total weight. Thin or elongated pieces are defined as stones whose average width exceeds four (4) times their average thickness. Elongated stones shall be considered to be stones whose average length exceeds four (4) times their average width. The Free Draining Base Stone shall be uniformly blended according to the gradation requirements for the respective stone sizes for the following:

<u>Sieve Designation</u>	<u>% Passing by Weight</u>	
	Minimum	Maximum
1 in.	100	--
3/4 in.	90	100
1/2 in.	30	60
3/8 in.	25	45
No. 4	5	30
No. 10	0	10

2. The material shall also meet the Los Angeles Abrasion Test ASSHTO T96 of not more than 45% loss and the Sodium Sulfate Soundness ASSHTO T104 of not more than 12%.
3. Free Draining Base Stone shall bridge with selected Free Draining Finishing Stone material to prevent loss of Free Draining Finishing Stone material into Free Draining Crushed Stone layer.
4. Free Draining Base Stone shall drain at a rate of not less than twenty (20") inches per hour after compaction.
5. Based upon the type and source of Free Draining Base Stone and Free Draining Finishing Stone submitted, other criteria may be required for approval.

C. Free Draining Finishing Stone:

1. Shall be inert angular crushed rock derived from a stone quarry that is hard, durable and free of deleterious materials and shall not consist of natural or crushed sand. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used. The Free Draining Finishing Stone shall be uniformly blended according to the target gradation requirements for the respective stone sizes for the following:

<u>Sieve Designation</u>	<u>% Passing by Weight</u>	
	Minimum	Maximum
1/2 in.	100	--
3/8 in.	85	100
No. 4	60	90
No. 8	35	75
No. 16	10	55
No. 30	0	40
No. 60	0	15
No. 100	0	8
No. 200	0	2

2. The material shall also meet the Los Angeles Abrasion Test ASSHTO T96 of not more than 45% loss and the Sodium Sulfate Soundness ASSHTO T104 of not more than 12%. A submittal of testing reports shall be provided showing compliance.
3. Installed Free Draining Finishing Stone shall drain at a rate of no less than the existing field as confirmed by Dual Ring testing after compaction.

4. Based upon the type and source of Free Draining Finishing Stone submitted, other criteria may be required for approval.

2.03 RESILIENT UNDERLAYMENT

A. Resilient Underlayment

1. Resilient underlayment shall be equivalent to SP-17 as manufactured by Brock USA, 2840 Wilderness Place, Boulder, CO 80301, (303) 544-5800.
2. Product must carry a sixteen (16) year warranty and cover the cost of turf replacement in the event of product failure. Manufacturer must guarantee as part of the standard warranty that the G-Max shall not exceed 1345 for the life of the turf.
3. If Contractor wishes to provide an equivalent, he shall provide information prior to the bid to the Landscape Architect/Civil Engineer showing equivalent performance characteristics of the underlayment.
 - a. The following performance criteria shall be met for the resilient underlayment:
 - (i) Underlayment shall be a minimum 17 mm thick.
 - (ii) Gmax of underlayment shall be between 75-135 throughout warranty period. Manufacturer must guarantee as part of the standard warranty that the G-Max will not exceed 135 for the life of the turf. Provide maximum average G-Max of field of 100 upon initial testing (ASTM F355-A).
 - (iii) Underlayment HIC (EN-1177)/(ASTM F355-16, E) not to exceed 1,000 from 1.4m drop for full turf system. The HIC of the pad alone must be below 1,000 from 0.6m drop height)
 - (iv) System must meet minimum critical fall height of 1.4m at installation with specified turf system.
 - (v) Product shall drain at greater than 300 inches per hour.
 - (vi) Warranty shall be 16 years or more and cover the cost to replace or repair the turf in affected area in the event of product failure.
 - (vii) When tested with the Deltec field tester, vertical deformation must remain between 6-12mm for the turf/pad system combined. Vertical deformation of less than 4 mm for sub-base without turf overlay when tested with Deltec Club Field Tester. Acceptable resistance to Bacteria (ASTM G22-76), fungus (ASTM G21-96) and chemicals – ASTM F925^{SEP}
 - (viii) Supplier must provide documentation that product meets human health screening levels and total threshold limit concentration using EPA Method 3052 and Title 22 (CAM 17) metals using EPA Method 6020/7471A and for hexavalent chromium using EPA Method 7196A.
 - (ix) Manufacturer must prove absence of heavy metals in production material, and a controlled chain of custody for all materials used.
 - (x) All material used in the artificial system must meet environmental and human health standards established in this specification. Documentation of chain of custody for materials may be required.
 - (xi) Product must be of a homogeneous material composition. Variable material content will not be accepted. Material must contain a minimum of 55% virgin Code 5 food grade expanded

Polypropylene by volume. Material must not absorb water. Open cell foams not acceptable.

2.04 INFILLED SYNTHETIC TURF SYSTEM (FIELDS)

A. Tufted Synthetic Turf:

1. Synthetic Turf Carpet shall be a dual fiber system comprised of monofilament and parallel slit film fibers.
 - a. Parallel Slit Film Fiber: Yarn shall be UV resistant designed for use in outdoor infilled synthetic athletic turf applications. The Parallel slit film shall be equivalent to TenCate XP Blade+ and shall comply with the following approved system requirements.
 - b. Monofilament Fiber: Yarn shall be a UV resistant polyethylene monofilament, designed for use in outdoor infilled synthetic athletic turf applications and shall comply with the following approved system requirements. Monofilament shall be shaped monofilament equivalent to TenCate Monoslide products.
2. Tufting of the fibers (for the dual fiber system) in a single needle is preferred and is required for systems with a stitch gauge of 1/2" or greater.
3. Minimum requirements for the approved turf systems are as follows:

Green Field Colors	Minimum two (2) different fiber colors for slit film fibers and two (2) different colors for monofilament fibers shall be selected by the Landscape Architect/Civil Engineer from the Manufacturer's Standard Colors. Refer to Drawings for alternating colored carpet panels at the Track & Field.
Line / Logo Colors	Shall be selected by the Landscape Architect/Civil Engineer from the Manufacturer's Standard Colors
Pile Denier	8,000 denier minimum per ASTM D 1907
Pile Height	2.00" minimum per ASTM D 5823
Stitch Gauge	3/8" preferred, 1/2" max. per ASTM D-5793
Face Weight	46 oz. minimum per s.y. per ASTM D-5848
Fiber Thickness	Slit film – 100 microns minimum per ASTM D 3218 Monofilament – 260 microns minimum
Tuft Bind	10 lbs. minimum without fill per ASTM D 1335
Grab Tear Strength (Average)	200 lbs. minimum per ASTM D-5034
Stitch Count	2.4 per inch minimum per ASTM D-5793
Elongation to Break	>50% per ASTM D-2256
Break Load	>25 lbs. per ASTM D-2256

- B. Reflective Fiber Technology: Fibers shall include additives which reflect light and reduce the ambient temperature of the turf system, if available to the manufacturer.

- C. Primary Carpet Backing:
1. Shall be equivalent to Multilayer Thiobac PRO K29 as manufactured by TenCate Grass North America, Dayton, TN. Vendor shall provide information on the layers used in the primary backing.
 2. If necessary, additional fabric layers or other provisions shall be made to accept butt-sewn seams. Additional layers or provisions shall not compromise the integrity of the system.
- D. Secondary Backing shall be high quality polyurethane specifically formulated for outdoor synthetic turf carpet. The Secondary Coating shall be heat treated to hold the yarn in place and shall meet the following requirements:
1. Weight 20 oz. per s.y. minimum
- E. Rolls shall be a minimum of 15 feet wide. Rolls shall be of sufficient length to cover from sideline to sideline without head seams.
- F. Seams
1. The Infilled Synthetic Turf System Vendor/Installer shall provide **glued seams at all panel connections and all inlaid lines.**
 2. The Infilled Synthetic Turf Installer is informed that all seams shall be flat and indiscernible upon installation. Shearing of the fiber pile will not be permitted as a means of achieving a flat seam. Infilling shall not commence until the Field Consultant is satisfied that all seams are flat and all trapped fibers are freed from the stitch.
 3. If an alternative method of seaming is proposed, information shall be provided to the Landscape Architect/Civil Engineer for consideration prior to the bid.
- G. Inlaid Lines
1. The Infilled Synthetic Turf Installer may install and secure the inlaid lines using seaming tape and glue or the shear and hot melt system.
 2. If the Infilled Synthetic Turf Installer plans to use seaming tape and glue, the components shall meet the following requirements:
 - a. Tape for securing inlaid lines and reference tick marks in the tufted synthetic turf shall be high quality coated cordura tape made specifically for Infilled Synthetic Turf applications with a minimum roll width of 12 inches.
 - b. Adhesives for bonding tufted synthetic turf shall be one part moisture cured polyurethane obtained from a single manufacturer and be equivalent Nordot 34-G as manufactured by Synthetic Surfaces, Scotch Plains, NJ (908) 233-6803. Adhesive shall be modified with amendments as recommended by the manufacturer for installation during adverse weather conditions.

- c. The installer will take all precautions not to get glue on the resilient underlayment. In the event that glue goes onto the underlayment, that piece will be removed and replaced.
- 3. If the Infilled Synthetic Turf Installer plans to use the shear and hot melt system, the Infilled Synthetic Turf Installer shall submit the machine and glue specifications for review.
- H. Line paint for games and field markings shall be latex semi-gloss enamel as recommended by the Infilled Synthetic Turf Contractor.
- I. If the Infilled Synthetic Turf Vendor or Installer intends to modify any of the above criteria, it is required that all modifications be approved in writing, by the Landscape Architect / Civil Engineer, prior to submitting a bid.

2.05 INFILLED SYNTHETIC TURF SYSTEM (BATTING CAGES)

A. Tufted Synthetic Turf:

- 1. Synthetic Turf Carpet shall be a dual fiber system comprised of parallel slit film fibers and a thatch:
 - a. Parallel Slit Film Fiber: Yarn shall be UV resistant designed for use in outdoor infilled synthetic turf applications. The Parallel slit film shall be equivalent to TenCate XP Blade+ and shall comply with the following approved system requirements.
 - b. Thatch: Yarn shall be a UV resistant polyethylene, designed for use in outdoor infilled synthetic turf applications and shall comply with the following approved system requirements. Thatch shall be equivalent to TenCate 6 Ply TXT Thatch products.

2. Minimum requirements for the approved turf systems are as follows:

Green Field Colors	Minimum two (2) different fiber colors for slit film fibers shall be selected by the Landscape Architect/Civil Engineer from the Manufacturer's Standard Colors.
Line / Logo Colors	Shall be selected by the Landscape Architect/Civil Engineer from the Manufacturer's Standard Colors
Pile Denier	8,000 denier minimum per ASTM D 1907
Pile Height	1.50" minimum per ASTM D 5823
Stitch Gauge	3/8" preferred, 1/2" max. per ASTM D-5793
Total Weight	74oz. minimum per s.y. per ASTM D-5848
Tuft Bind	10 lbs. minimum without fill per ASTM D 1335
Grab Tear Strength (Average)	200 lbs. minimum per ASTM D-5034
Stitch Count	2.4 per inch minimum per ASTM D-5793

Elongation to Break	>50% per ASTM D-2256
Break Load	>25 lbs. per ASTM D-2256

- B. Reflective Fiber Technology: Fibers shall include additives which reflect light and reduce the ambient temperature of the turf system, if available to the manufacturer.

- C. Primary Carpet Backing:
 - 1. Shall be equivalent to Multilayer Thiobac PRO K29 as manufactured by TenCate Grass North America, Dayton, TN. Vendor shall provide information on the layers used in the primary backing.
 - 2. If necessary, additional fabric layers or other provisions shall be made to accept butt-sewn seams. Additional layers or provisions shall not compromise the integrity of the system.

- D. Secondary Backing shall be high quality polyurethane specifically formulated for outdoor synthetic turf carpet. The Secondary Coating shall be heat treated to hold the yarn in place and shall meet the following requirements:
 - 1. Weight 20 oz. per s.y. minimum

- E. Rolls shall be a minimum of 15 feet wide.

- F. Seams
 - 1. The Infilled Synthetic Turf System Vendor/Installer shall provide **glued seams at all panel connections and all inlaid lines.**
 - 2. The Infilled Synthetic Turf Installer is informed that all seams shall be flat and indiscernible upon installation. Shearing of the fiber pile will not be permitted as a means of achieving a flat seam. Infilling shall not commence until the Synthetic Turf Consultant is satisfied that all seams are flat and all trapped fibers are freed from the stitch.
 - 3. If an alternative method of seaming is proposed, information shall be provided to the Landscape Architect/Civil Engineer for consideration prior to the bid.

- G. If the Infilled Synthetic Turf Vendor or Installer intends to modify any of the above criteria, it is required that all modifications be approved in writing, by the Landscape Architect / Civil Engineer, prior to submitting a bid.

2.06 INFILL MATERIALS (FIELDS)

- A. The Infilled Synthetic Turf Vendor shall provide a signed letter on company letterhead stating that their system (with the resilient underlayment) using the infill mix ratio below will meet performance requirements set forth in this specification. In the event that the Vendor does not believe they can meet the performance criteria within this specification, the Vendor shall provide a request to the Landscape Architect/Civil Engineer prior to the date questions are due with a requested alternative mix ratio.

- B. Infill Materials shall be uniformly filled to a depth which leaves no more than 1/2” of exposed pile after settlement, and consists of a homogeneous non-compacting mixture of silica sand and resilient granules meeting the following criteria:

1. The sand:rubber content shall be 60%:40% by weight +/-2%.
2. Silica sand shall meet the following criteria:
 - a. Infill sand shall be high quality clean grains of rounded silica sand (SiO₂) equivalent to:
 - (i) Granusil 4095
Unimin Corporation, New Cannan, CT

203-966-8880
20/40 HC
 - (ii) Oglebay Norton, Brady, TX

915-597-0721
20/40 Oil Frac
 - (iii) US Silica, Ottawa, IL
800-243-7500
 - b. Angular or sub-angular particles will not be accepted. Sand shall have 100% passing the #16 sieve, no more than 80% passing the #30 sieve and no more than 0.5% passing the #50 sieve per ASTM E-11 and also meet the following requirements:
 - (i) Hardness 7.0 Mohs
 - (ii) Moisture Content <0.1% per ASTM C-566
 - (iii) Specific Gravity 2.65 g/cm³ per ASTM C-128
 - (iv) Aerated Bulk Density 92-102 lb/ft² per ASTM C-29
 - (v) Compacted Bulk Density 98-110 lb.ft² per ASTM C-29
3. Resilient granules shall meet the following criteria:
 - a. SBR Rubber - Granules shall be processed recycled rubber derived from passenger tires. Rubber shall containing no dust or contaminants and shall work to hold the infill sand in suspension. Color to be black.
4. Samples of the free draining, homogenously blended infill (and separate sand and resilient granules) shall be submitted to the Landscape Architect / Civil Engineer for review. Samples shall also be sent by the Infilled Synthetic Turf Vendor to an independent testing laboratory to confirm that the infill is free draining and meets (or exceeds) the drainage requirements set forth in this specification. Copies of the testing reports shall be submitted to the Landscape Architect / Civil Engineer for review. The Infilled Synthetic Turf Vendor is responsible for costs associated with infill testing.

2.07 INFILL MATERIALS (BATTING CAGES)

A. Infill Materials shall be uniformly filled to a depth which leaves no more than 1/2” of exposed pile after settlement, and consists of a homogeneous non-compacting mixture of silica sand meeting the following criteria:

1. Silica sand shall meet the following criteria:

a. Infill sand shall be high quality clean grains of rounded silica sand (SiO₂) equivalent to:

(i) Granusil 4095
Unimin Corporation, New Cannan, CT

203-966-8880
20/40 HC

(ii) Oglebay Norton, Brady, TX

915-597-0721
20/40 Oil Frac

(iii) US Silica, Ottawa, IL
800-243-7500

b. Angular or sub-angular particles will not be accepted. Sand shall have 100% passing the #16 sieve, no more than 80% passing the #30 sieve and no more than 0.5% passing the #50 sieve per ASTM E-11 and also meet the following requirements:

- | | | |
|-------|------------------------|---|
| (i) | Hardness | 7.0 Mohs |
| (ii) | Moisture Content | <0.1% per ASTM C-566 |
| (iii) | Specific Gravity | 2.65 g/cm ³ per ASTM C-128 |
| (iv) | Aerated Bulk Density | 92-102 lb/ft ² per ASTM C-29 |
| (v) | Compacted Bulk Density | 98-110 lb.ft ² per ASTM C-29 |

2. Samples of the free draining infill shall be submitted to the Landscape Architect / Civil Engineer for review. Samples shall also be sent by the Infilled Synthetic Turf Vendor to an independent testing laboratory to confirm that the infill is free draining and meets (or exceeds) the drainage requirements set forth in this specification. Copies of the testing reports shall be submitted to the Landscape Architect / Civil Engineer for review. The Infilled Synthetic Turf Vendor is responsible for costs associated with infill testing.

2.08 INFILLED SYNTHETIC TURF MAINTENANCE EQUIPMENT

A. Provide one (1) Synthetic Sports Turf Groomer with Spring Tine Rake for routine maintenance of field as manufactured by GreensGroomer WorldWide, Inc., PO Box 34151, Indianapolis, IN 46234. (888) 298-8852.

B. Provide one (1) LitterKat Synthetic Turf Sweeper with Tow Magnet as manufactured by GreensGroomer WorldWide, Inc., PO Box 34151, Indianapolis, IN 46234. (888) 298-8852.

PART 3 - EXECUTION

3.01 GENERAL

- A. The substrate to receive the Infilled Synthetic Turf System shall be inspected and certified by the Base Contractor and the Infilled Synthetic Turf System Installer (if the Infilled Synthetic Turf Installer is not a direct employee of the Infilled Synthetic Turf Vendor, then a representative of the Infilled Synthetic Turf Vendor shall also be present and provide certification) as ready for the installation of the Infilled Synthetic Turf System and must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.
- B. All installation operations shall be performed by personnel fully familiar with the materials and their application, under the full time direction and supervision of a qualified technical supervisor directly employed by the Infilled Synthetic Turf System Vendor. Refer to QUALITY CONTROL – Experience section of this specification.

3.02 BASE INSTALLATION

- A. Geotextile Fabric:
 - 1. Install geotextile Fabric over excavated and prepared subgrade and the bottom and sides of the excavated drainage system and perimeter trenches in accordance with Manufacturer’s recommendation. Provide 1/3 minimum overlap at all seams.
- B. Synthetic Turf Field Underdrains:
 - 1. Flat drains shall be installed in accordance with the details on the Contract Drawings and manufacturer’s instructions and recommendations.
 - 2. All flat drains will direct-connect to the perimeter drain pipe with appropriate fittings.
- C. Free Draining Base Stone:
 - 1. Install to the depth as shown in the Project Details. The material shall be fine graded and suitably rolled and compacted to achieve a tolerance of 1/4" in 25’.
 - 2. The Free Draining Base Stone layer shall be inspected by the Base Contractor by means of a laser level on a 25-foot grid pattern.
 - 3. The Base Contractor shall verify that the Free Draining Base Stone layer and Subsurface Drainage System are functioning properly prior to installing the Free Draining Finish Stone later. Provide written verification to the Landscape Architect.
 - a. If the base materials fail to drain at the specified rates, they shall be repaired or removed and replaced at no cost to the Owner until they achieve the specified requirements.
- D. Free Draining Finishing Stone:
 - 1. Free Draining Finishing Stone shall be fine graded and suitably rolled and compacted to achieve a tolerance of 1/8” in 10’.

- a. Fine grading operations shall be completed using a hydraulically controlled laser grading apparatus. The use of a drag behind or box grader shall not be allowed.
 - b. The Free Draining Finishing Stone Layer shall be tested to ensure a 95% maximum dry density per a standard proctor test. Contractor to complete testing and provide results to Owner's Representative.
2. The Free Draining Finishing Stone layer shall be inspected by an Independent Testing Company for planarity and drainage. All testing results will be submitted to the Landscape Architect/Civil Engineer and the Infilled Synthetic Turf Vendor for review and approval.
- a. Planarity Testing
 - (i) Upon completion of fine grading, complete a 3-meter straight edge planarity test across the field by an Independent Testing Company to show compliance with the 1/8" in 10' tolerance.
 - (ii) The Base Contractor shall be responsible for fixing all deficiencies in the base to provide a base that meets the specified tolerance.
 - b. Drainage Testing
 - (i) Upon completion of fine grading, complete a Dual Ring Infiltrometer Testing (ASTM D3385-9), (or other pre-approved method) by an Independent Testing Company coordinated and paid for by the Contractor. Five (5) tests per field shall be performed in locations determined by the Landscape Architect/Civil Engineer and/or Owner. Each test location shall have a permeability rate in excess of ten (10) inches per hour.
 - (ii) If preliminary results in the field do not yield ten (10) inches per hour, the Landscape Architect/Civil Engineer and/or Owner may ask for additional locations to be tested. The Base Contractor and the Infilled Synthetic Turf Vendor shall provide written verification to the Landscape Architect/Civil Engineer that that the base and subsurface drainage system are functioning properly. Commencement of subsequent work prior to written verification constitutes acknowledgement that the systems are functioning properly.
 - c. If the base materials fail to drain at the specified rates, they shall be repaired or removed and replaced at no cost to the Owner until they achieve the specified requirements.
- E. The Base Contractor and the Infilled Synthetic Turf Vendor shall verify that the Subsurface Drainage System, Free Draining Crushed Stone layer and Free Draining Finishing Stone layer are functioning properly prior to work performed by Infilled Synthetic Turf Vendor begins. Provide written verification to the Landscape Architect/Civil Engineer.

3.03 INFILLED SYNTHETIC TURF SYSTEM INSTALLATION

- A. Upon final written certification from the Base Contractor and Infilled Synthetic Turf Vendor that the field base is working correctly, the Infilled Synthetic Turf System installation shall commence.
- B. Resilient Underlayment
 - 1. Installation shall be performed by manufacturer’s technicians and shall comply with the manufacturer’s guidelines for the complete placement of the panelized, polypropylene resilient underlayment.
 - 2. Deviation in the straightness of the line can be caused by displacement of panels from vehicles traffic and incorrect fitting. Before beginning each new row, the installers are to check the seam lines and outside edge of the installed area to ensure that it is straight and true. If at any time there is a noticeable deviation in straightness, corrective action is to be taken by carefully adjusting the panels before proceeding with further panel installation. This may require removing the panels that have deviated and reinstalling correctly.
 - 3. Cutting of Resilient Underlayment panels within the playing area will not be permitted. Cutting of Resilient Underlayment shall occur only as needed at the field perimeter and occur per manufacturer’s installation requirements and instructions.
 - 4. Upon completion of Resilient Underlayment installation, the Resilient Underlayment shall be inspected for planarity and grade and all deviations shall be corrected by tamping with a hand operated vibratory plate compactor.
- C. Tufted Synthetic Turf Rolls shall be manufactured to maximize tufting of permanent athletic field lines and installed perpendicularly across the field. Turf rolls shall be of sufficient length to permit full cross-field (sideline – sideline) installation. No head or cross seams will be allowed. Once all playing surface rolls have been installed, install sideline rolls perpendicularly to playing surface rolls and glue entire panel to turf anchor and anchor by stainless steel screws or ramset at a maximum of 18-inch intervals directly to the turf anchor shelf. Rolls shall be installed so that tufted lines are placed as shown on the approved Shop Drawings.
- D. Tufted Synthetic Turf shall be installed with no wrinkles, ripples or bubbles. Shearing of fibers, slits in the fabric or driven spikes or staples to relieve such defects will not be permitted.
- E. All Tufted Synthetic Turf seams shall be glued as stated above. Seams shall be flat, tight, and permanent with no separation or fraying. Tufted Synthetic Turf Yarn pile that is trapped between seams shall be freed from the seams by hand or other approved method to an upright position prior to brushing and infilling. Extreme care shall be taken to prevent carpet pile from becoming trapped underneath the infill. If necessary, the Landscape Architect / Civil Engineer may direct the Infilled Synthetic Turf Installer to completely remove and reinstall the infill.
- F. All inlaid lines and other field markings shall be adhered with high strength tape and glued as specified. Inlaid seams shall be flat, tight, and permanent with no separation or fraying.

Yarn pile that is trapped or glued between inlay seams shall be freed from the seams by hand or other approved method to an upright position prior to brushing and infilling.

- G. Contractor to provide an As-Built Field Layout Drawing prior to infilling with verification and certification that the field layouts meet the requirements of the project documents.
- H. Upon completion of seaming and inlaying and prior to infilling, the entire field shall be brushed with a motorized rotary nylon broom to free trapped or tangled fibers. The blended infill materials shall be spread evenly by using a drop spreader in multiple applications at uniform rates until the specified infill depth (after settlement) is achieved. Between applications the infill materials shall be brushed in multiple directions with a static nylon groomer.
- I. Refer to PERFORMANCE TESTING ON FINAL SURFACE for testing requirements following infill installation completion.
- J. Upon completion, the Infilled Synthetic Turf Vendor/Installer shall deliver assembled maintenance equipment to the Owner.

3.04 FIELD LAYOUT

- A. Field layouts shall be in accordance with each sport’s governing body rules, the Drawings and the Approved Shop Drawings.
- B. Football Field:
 - 1. Field shall be marked in accordance with DIAA/NFHS Football Rules and Interpretations, latest edition.
 - 2. Color to be white.
 - 3. Football field shall have 4-inch wide factory tufted five-yard lines, 8-inch goal lines, 12-inch wide factory tufted football sidelines and end lines, and factory tufted coach’s boxes per the Contract Documents and approved Shop Drawings. To the extent feasible, additional boundary lines and markings shall be tufted in the factory.
 - 4. Field shall have white inlaid short line extensions, hash marks, inbound lines, three-yard lines, line to gain and down indicator reference points per the Contract Documents and approved Shop Drawings.
 - 5. Custom Ten-yard numerals shall be inlaid.
 - 6. Layout shall begin from the center of the 50-yard line which shall be verified between the installed football goal post locations. Perimeter dimensions are taken to the inside of the line.
- C. Soccer Field shall be marked in accordance with DIAA/NFHS Soccer Rules and Interpretations, latest edition and shall have 4” wide Yellow lines (refer to Field Line Layout Drawings). The maximum amount of lines shall be tufted in the factory and the remainder inlaid per the Contract Documents and approved Shop Drawings.
- D. Field Hockey Field shall be marked in accordance with NFHS Field Hockey Rules and Interpretations and shall have 3” Black inlaid lines. The maximum amount of lines shall be tufted in the factory and the remainder inlaid per the Contract Documents and approved Shop Drawings.

- E. Girl's Lacrosse Field shall be marked in accordance with NFHS Girl's Lacrosse Rules and Interpretations, latest edition and shall have 2" wide Gray inlaid lines. The maximum amount of lines shall be tufted in the factory and the remainder inlaid per the Contract Documents and approved Shop Drawings.
- F. Boy's Lacrosse Field shall be marked in accordance with NFHS Boy's Lacrosse Rules and Interpretations, latest edition and shall have 4" wide light blue inlaid lines. The maximum amount of lines shall be tufted in the factory and the remainder inlaid per the Contract Documents and approved Shop Drawings.
- G. The following shall be provided and installed in the field:
 - 1. One (1) midfield logo at each field as indicated on the plans and details using standard fiber colors to be selected by the Owner.
 - 2. Track and Field to receive Custom End Zone Lettering, as shown on the plans and details using standard fiber colors to be selected by the Owner.
 - 3. Secondary Turf Field to receive Custom Sideline Lettering, as shown on the plans and details using standard fiber colors to be selected by the Owner.
 - 4. All logos shall be laid out in the field for Owner's review prior to installation.
 - 5. Electronic files for the logo will be provided to the awarded bidder in order for the turf vendor to prepare shop drawings and submittals for review. Internet downloads and scans of the drawings shall not be used to fabricate turf logos.
- H. Provide As-Built drawing including verification of field layout dimensions in accordance of with CONTRACT CLOSEOUT.

3.05 ACCEPTANCE

- A. Should any imperfections develop in the substrate or surface prior to the final acceptance of the work, they shall be properly repaired with the removal and replacement of materials as required.
 - 1. All such repair work shall be done at no additional cost to the Owner.

3.06 CLOSE OUT

- A. Infilled Synthetic Turf System Vendor shall provide the Landscape Architect / Civil Engineer and Owner with three (3) copies of the approved Standard Warranty, Third Party Insured Warranty, and Testing Results.
- B. Infilled Synthetic Turf System Vendor shall train the Owner's designated personnel in the proper maintenance and care of the field and provide the Landscape Architect / Civil Engineer and Owner with three (3) copies of the Standard Maintenance Manual. Training shall at a minimum address:
 - 1. Use and maintenance of equipment including when/how often to use the particular pieces of machinery, how fast/slow to operate machinery, etc.
 - 2. How to clean stains/markings from the field.
 - 3. Snow removal (plow versus snowblowing, etc.)

4. What to do if a problem is encountered in the field – who to call/contact.
5. Any small repairs that can be done by the Owner (if any) without affecting the warranty.
6. How to inspect a field and what to look for as well as how often this should be done.
7. Maintenance Log Information – discuss the importance in respect to warranty.

3.07 CLEAN UP

- A. Infilled Synthetic Turf System Vendor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items.
- B. All useful and usable remnants of new materials shall become the property of the Owner. A minimum of 1,000 square feet of tufted synthetic turf shall be provided including at least one 15 foot by 15 foot section, per field.
- C. One (1) 50 gallon drum of sand and one (1) 50 gallon drum of SBR rubber shall be provided to the Owner for storage, per field.
- D. 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.

3.08 POST CONSTRUCTION FIELD MAINTENANCE PROGRAM

- A. Subsequent to Final Completion, provide the Owner with one (1) year of Post Construction Field Maintenance Services including but not limited to:
- B. A complete inspection of the entire field area to include:
 1. Inspection of seams, penetrations and connections.
 2. Inspection of Carpet Pile for premature fading, excessive fibrillation, wear and/or decreased height and weight.
 3. Inspection of the Infill for depth and consistency. Infill shall be top dressed as necessary to meet the height requirements of these specifications.
 4. Inspection of the Infill for consistency of feel and excessive hardness or softness.
 5. Immediate repair or replacement to correct deficiencies noted during inspection.
 6. Complete brushing of the field with a motorized rotary broom to redistribute and level the Infill and rejuvenate the Carpet Pile.
 7. Provide G-Max testing.
- C. Provide a Complete Field Service Report of all observations and activities to the Owner and Landscape Architect / Civil Engineer.
- D. Post Construction Field Maintenance shall be performed a minimum of two (2) times during the first full year after Final Completion. Timing of the Post Construction Field Maintenance shall be performed at the discretion and approval of the Owner and with at least fourteen (14) days prior notice to the Owner.

3.09 EMERGENCY SERVICE

- A. Provide the Owner with a 24-hour emergency response time for all field repair issues.

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END OF SECTION

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**SECTION 32 18 23.33
RESILIENT TRACK SURFACE**

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 010000 – GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 WORK INCLUDED

- A. Contractor shall furnish a track surface as specified herein and in accordance with the drawings, manufacturer's specifications and directions of the Landscape Architect/Civil Engineer.
- B. Resilient track surface work includes, but is not limited to:
 - 1. Provide a 10 mm paved-in-place black EPDM or SBR rubber base mat with a two component 3 mm seal coat finished with embedded EPDM granules and light encapsulation for a 400-meter track (42" lanes – 8 lane oval) and "D" areas.

1.01 RELATED WORK

- A. Site Preparation
- B. Cast-in-Place Concrete
- C. Athletic Ball Netting System
- D. Athletic Equipment
- E. Track Bituminous Concrete Pavement
- F. Infilled Synthetic Turf System
- G. Athletic Storm Drainage System

1.02 REFERENCES

- A. ASBA - American Sports Builders Association
- B. ASTM - American Society for Testing Materials
- C. IAAF – International Amateur Athletic Association
- D. NFHSA – National Federation of State High School Associations
- E. DIAA – Delaware Interscholastic Athletic Association

1.03 QUALITY ASSURANCE

- A. Experience: Track surfacing shall be performed by an experienced specialty firm which shall have laid at least ten (10) track surfaces of the type and installation process herein specified within the last three-year period. The applicator of the system must be authorized by the manufacturer.

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- B. Guarantee: The Contractor shall guarantee all materials and workmanship against damage by climatic conditions or proper and normal use (including the use of running spikes) for a minimum period of five (5) years from the official date of substantial completion.
- C. The Contractor shall inspect the bituminous pavement construction to verify their acceptance of condition. Commencement of track surfacing installation in a given work area indicates acceptance of underlying substrates.
- D. Security: Contractor shall be responsible for the proper protection and watching of the works at all times to ensure both uncured and cured surfacing is not subject to casual damage or vandalism.
- E. Restoration of Damage: Contractor shall exercise care in the execution of his work and avoid damage or defacement of adjacent or surrounding areas by using suitable protective means. Damage or defacement which occurs shall be remedied at Contractor's cost to the satisfaction of the Owner.
- F. Planarity and Grade: Deviation in planarity of the finished surface shall not exceed 1/8" beneath a 10' straightedge. Deviation from a straight grade between levels on drawings shall not exceed 1/8".
- G. Thickness: The finished thickness shall be a minimum of 1/2" (13mm). For purposes of this specification, surface thickness is defined as the dimension from the top of the bituminous concrete to the lowest point in the finished surface texture of the resilient track surface.
- H. Heavy equipment or vehicles of any kind should not be allowed on the surface for a minimum of four weeks, after which time, only where protected by a sufficient crossing mat.

1.04 SUBMITTALS

- A. General: Submit the following with the Form for General Bid in accordance with Conditions of the Contract and Division 1 Specification Section.
 - 1. A recent reference list of at least ten (10) tracks of the type and installation process specified herein with contract name, address and telephone number to enable such data to be validated at the time of the submission of bids.
 - 2. A written five (5) year labor and materials warrantee from both the Contractor and Manufacturer.
 - 3. A general statement of the method by which the surface is laid, including method of mixing and chief items of equipment used.
 - 4. Statement of method by which small repairs or retexturing may be achieved.
 - 5. Statement indicating the name of the registered engineer, land surveyor or certified track builder who will layout the track, and a copy of his/her registration.
 - 6. A certificate from the surfacing manufacturer that the Contractor is authorized to apply the specified materials.
 - 7. Written certification from a licensed engineer, land surveyor, or Certified Track Builder (CTB) that the bituminous base layout and elevations comply with the drawing and specifications prior to laying the resilient track surface.
 - 8. A certificate from the manufacturer of all binder materials that they have been produced specifically for use in outdoor running track surface construction.
 - 9. Stamped certification from an IAAF approved testing laboratory that each item used in the construction of the running surface has been tested and meets the requirements of the IAAF and ASTM for running track surface construction.

10. Written certification from a licensed engineer, land surveyor, or Certified Track Builder (CTB) that the track and field events layout and elevations comply with the drawing and specifications and the requirements of the DIAA and NFHS.
- B. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Section.
1. Shop drawings which illustrate the scope of work, including layout of all track events, materials and colors.
 2. A set of maintenance instructions for the surface.
 3. Samples of the proposed surface for use as a control for site work.
 4. Samples of 1/2" thickness as follows: two (2) samples minimum 4"x 4", two (2) samples minimum 12"x 12".
 5. These samples should be representative in every way of the composition, strength and texture of the material to be produced on-site and may be tested for comparison with submitted test data and to establish a datum performance for subsequent site quality control purposes.
 6. Statement of the curing conditions necessary to achieve full cure of site samples within three days.
 7. Color samples of line paints.
 8. Delivery slips for all track surfacing materials delivered to the site.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products in exact accordance with the manufacturer's requirements and specifications.

1.06 PROJECT CONDITIONS

- A. Weather Limitations: No part of the construction shall be conducted during a rainfall or when rainfall is imminent. No part of the construction shall be conducted unless both ambient and materials temperatures are at least 50 degrees Fahrenheit and rising.
- B. Bituminous and resilient track surfaces shall be dry, as well as clean prior to work. Binder should not be applied within 12 hours after rainfall, or when rainfall is forecast. After a rainfall, sufficient time shall be given to allow the surface to dry before resuming work.
- C. The facilities shall not be used for a minimum period of one week after completion of the track.

PART 2 PRODUCTS

2.01 GENERAL

- A. This specification covers the installation of a new, high performance resilient track surfacing system for new asphalt surfaces. This track system utilizes specially compounded, pigmented, binders and select rubber granules to provide strength, flexibility and to prevent ultra violet degradation. The system is intended to provide a durable, resilient, spike resistant surface for recreational and competitive high school use.

2.02 MATERIALS

- A. The resilient track surface shall be a durable, resilient, textured, all-weather surface consisting of a polyurethane-bound pigmented EPDM or SBR rubber base mat with a flood coat and

embedded wearing course equivalent to BSS-300 as manufactured by Beynon Sports Surfaces, Hunt Valley, MD (410) 771-9473 and which meets the following requirements.

1. Urethane Primer:
 - a. A urethane-based tack coat interface that has been pre-tested and is certified by the manufacturer to be compatible with the bituminous base and the resilient track surface.
2. Paved Mat Surface:
 - a. 100% MDI (methylene diphenyl isocyanate) Polyurethane Binders containing no clay or mineral fillers.
 - b. Base Material:
 - 1) Base Mat Granulate: A mixture of uniformly-graded SBR rubber granulars bound with polyurethane binders containing no mineral fillers. The SBR rubber granules shall have a particle size grading of 1 mm to 3 mm. Color shall be black.
 - 2) Polyurethane Base Mat Binding Agent: Single component, solvent free MDI-based polyurethane binder, specially formulated and compatible with SBR rubber granules.
3. Wearing Material:
 - a. The base material shall be sealed with a self-leveling two component polyurethane compound containing no solvents, TDI or mercury. Colors shall be Navy Blue and Gray at the jump runways and relay transition zones.
 - b. A mixture of uniformly graded EPDM rubber granules shall be integrated into the polyurethane seal (embedded) coat. EPDM granules shall have a particle size grading of 1 mm to 3 mm. The application of EPDM dust is not allowed. Color to be Navy Blue and Gray; refer to Track Striping Plan for intended color transitions.
4. Encapsulation
 - a. Provide light encapsulation final seal of the surfacing with water-based polyurethane structural spray product equivalent to BEYPUR 160.
 - b. The encapsulation spray shall be color matched to the Wearing Materials.
5. Minimum Physical properties of the Surface:

a. Thickness	1/2" (13mm)
b. Base Mat Color	Black
c. Wearing Course Color	Navy Blue and Gray
d. Elongation (ASTM D-412)	28%
e. Tensile strength (ASTM D-412)	36.2 PSI
f. Abrasion Resistance (ASTMD-501) 1,000 cycles	0.25-0.425 grams loss after
g. Resilience (ASTM D-2632)	37%-44%
h. Tear Resistance (ASTM D-624)	50-75 psi
i. Chalking (ASTM D-822) in weatherometer	No change after 1,000 hrs.
j. Hardness (ASTM D42240)	Shore A @ 30 to 50
k. Coefficient of Friction (ASTM D-1894)	Dry 0.70-0.75, Wet 0.80-0.95

PART 3 EXECUTION

3.01 GENERAL

- A. Surface Inspection: Prior to the application of the resilient track surface, the bituminous concrete pavement base shall be inspected for conformity to planarity requirements. The

surface shall not deviate more than 1/8" in 10' from the specified grade when checked with a 10' straightedge. This surface shall also be flooded with water to verify the drainage. Any areas found not to be in conformance with the above requirements shall be repaired and allowed to cure prior to the application of the synthetic surface with compatible materials as approved by the manufacturer.

- B. The bituminous concrete pavement base surface shall be clean and free from contamination by oils, grease, diesel, gasoline, hydraulic fluid, anti-freeze or other chemical agents or excessive amounts of dust, dirt or organic matter before layering the surface or it will be cleaned to the satisfaction of the Landscape Architect/Civil Engineer by pressure-washing or replacement of the contaminated bituminous concrete.
- C. At least twenty-one (21) days shall have elapsed between completion of the bituminous concrete pavement base and commencement of the synthetic surfacing work. If no rain has fallen since completion of the bituminous concrete, the Contractor shall provide for hosing down the bituminous concrete once during the period, not less than two (2) days before commencement of the synthetic surfacing.
- D. No surfacing work will proceed when there is moisture on any of the surfaces to be coated. Surfacing shall be laid only on completely dry sub-surfaces.
- E. All machinery and tools shall be clean and serviceable and hold no accumulations of cured material. Machinery and tools will be cleaned at the end of each day's work, and at appropriate intervals during the workday.
- F. Installation shall not take place if adjacent or concurrent construction generates excessive dust, abrasives or any other by-product that, in the opinion of the Landscape Architect or Owner's Representative, and/or Installer would be harmful to the track material until completion of such works.
- G. If, in the opinion of the Installer of the synthetic material, the weather and/or climatic conditions are detrimental to the proper installation of the surfacing materials, work shall be delayed until conditions are acceptable. Preferred installation temperature is 50 degrees Fahrenheit and rising. Installation shall be executed only in dry conditions.

3.02 INSTALLATION

- A. Urethane Paved Mat System
 - 1. After Track Engineer's, Land Surveyor's or CTB's written approval of the bituminous base, a urethane tack coat shall be applied in accordance with the manufacturer's recommendations to areas which will be surfaced within a two (2) day period at a rate of 0.03 gallons per square yard. Allow tack coat to dry thoroughly before surfacing. After significant rainfall or other instances of surface flooding, reapply tack coat to ensure proper adhesion.
 - 2. The base mat shall consist of a minimum of twenty (20%) percent polyurethane binder and a maximum of eighty (80%) percent SBR rubber granules as determined by the overall weight of the mixture. The mixture shall be prepared in a clean and dry mechanical mixer until a homogenous mixture is obtained. A mechanically operated finisher with an electronically heated finishing screed-bar shall apply the blended materials. All joint work shall be troweled flush with the adjacent base mat. All joints shall have their edges primed with the base mat, binding agent prior to application of the adjacent base mat.
 - 3. After the initial cure is complete, the base mat shall be sealed with a thickened two-component polyurethane, squeegee applied. EPDM granules shall be integrated into the polyurethane to achieve full depth of the flood and chip system. The resilient embedded

textured finish shall be a dense matrix of exposed EPDM granules. Color shall be Navy Blue and Gray.

3.03 QUALITY CONTROL

- A. The Landscape Architect/Civil Engineer reserves the right to make any and all tests it may deem necessary to determine the physical properties, thickness and quality of the synthetic materials being installed. The Contractor shall supply samples of ingredients or mixed materials whenever requested to do so. Contractor shall supply trays 1/2" deep, not less than 12"x12" and coated with release agent for the purpose of sampling.
- B. During the course of the work, Contractor shall maintain at the site, accurate weighing scales for the purpose of checking batching ratios.
- C. Samples taken from the site and submitted to accelerated curing in accordance with the Contractor's statement shall be expected to achieve ninety (90%) percent of the performance of the control specimens submitted.
- D. Following completion of the embedded rubber layer the Landscape Architect/Civil Engineer will test for the required surface depth using a SMG – Sportplatzmaschinenbau GBMH surface depth gauge. The track and events areas will be checked in no less than 100 locations at the center of the inner and outer lanes, as well as the center of the oval. If at least 20% of the readings do not meet the specified depth, additional layers of rubber and binder will be applied until the proper depth has been achieved.

3.04 MEASUREMENTS AND MARKINGS

- A. Wait forty-eight (48) hours after completion of track surface before applying line paint.
- B. All work of this section shall conform to DIAA specifications.
- C. The Contractor shall supply all labor, materials and equipment necessary to perform the following:
 - 1. Locate and establish all radius points.
 - 2. Establish and set all necessary control points.
 - 3. Lay out all lines and markings to within 1/2 inch (13 mm) tolerance.
 - 4. Prepare all necessary drawings.
 - 5. Provide all computations and measurements in organized form.
 - 6. Establish all locations on the curves using a transit or Theodolite capable of reading direct to 20 seconds.
 - 7. Identify all markings, where appropriate, by painting the identification directly onto the track surface in 4 inch (10.16 cm) letters just below or in front of each mark in the right hand portion of the lane.
 - 8. Paint all the large 3 feet (91.4 cm) high lane numbers, 4 sets in custom font, as shown in Drawings.
 - 9. All lines shall receive sufficient paint to assure complete opacity and uniformity of color.
 - 10. Paints shall be used directly from original containers and shall be thinned only when hot weather dictates some thinning for purposes of smooth application.
 - 11. Amount of paint used shall be as recommended by the manufacturer.
 - 12. Competent, experienced and fully qualified personnel shall make all measurements.
 - 13. Upon completion of the track markings, a licensed professional engineer, registered land surveyor or certified track builder shall furnish an acceptable letter of, or certificate of, accuracy to the owners attesting to the accuracy of the track markings and measurement and shall include copies of the computations, calculations and drawings that were used to

obtain this accuracy. The engineer or surveyor should affix his stamp to the drawing and the certificate.

14. The marking shall include all the events and marks required or recommended for the following track events:

- a. 100 meter dash (2)
- b. 200 meter dash
- c. 400 meter run
- d. 800 meter run
- e. 1500 meter run
- f. 3000 meter run
- g. 5000 meter run
- h. One mile run
- i. Two mile run
- j. 75 meter hurdles (boys/girls)
- k. 100 meter hurdles (girls)
- l. 110 meter high hurdles (boys)
- m. 300 meter hurdles
- n. 400 meter intermediate hurdles (lines to be dotted in)
- o. Shuttle hurdles (boys/girls)
- p. 400 meter relay
- q. 800 meter relay
- r. 1600 meter relay
- s. 3200 meter relay
- t. Practice starts at the far end of each straightaway
- u. Long/Triple Jump
- v. Pole Vault

- D. Coordinate all line markings with Landscape Architect/Civil Engineer and Owner prior to installation.

3.05 CLEAN UP AND MAINTENANCE

- A. Upon completion of the work, the Contractor shall remove all containers, surplus materials and debris. The site will be left in a clean orderly manner acceptable to the Owner and Landscape Architect/Civil Engineer.
- B. Upon completion of the work, provide the owner with maintenance requirements for the track surface.

END OF SECTION

**SECTION 32 18 23.53
TENNIS COURT SURFACING**

PART 1 - GENERAL

2.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 00 00 – GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

2.02 WORK INCLUDED

- A. Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. Tennis Court Surfacing

2.03 RELATED WORK UNDER OTHER SECTIONS

- A. Athletic Equipment
- B. Bituminous Concrete Pavement
- C. Chain Link Fence and Gates
- D. Loam and Seed

2.04 REFERENCES

- A. Work shall conform to codes and standards of the following:
 - 1. American Sports Builders Association (ASBA).
 - 2. United States Tennis Association (USTA)

2.05 SUBMITTALS

- A. Manufacturer's product data shall be submitted for all surfacing and repair materials and application methods. The submittal shall include information on all materials proposed as well as the typical layer section of materials including acrylic binder, cushioned filler coats as required, finish coatings and line paints.

2.06 QUALITY ASSURANCE

- A. An experienced specialty firm that shall have surfaced a minimum of fifteen (15) courts in the last year shall perform court surfacing. Firm shall submit references.

PART 2 - PRODUCTS

3.01 COURT SURFACING MATERIAL

- A. The surfacing shall be a minimum four coat, 100% acrylic latex-type system containing no asphalt or tar emulsions and no vinyls, alkyds, or non-acrylic resins equivalent to "Plexipave Plexi Hardcourt System", as manufactured by California Products Corp., Andover, MA 01810 or "Laykold Color Flex System as manufactured by Advanced Polymer Technology Corp. 109 Conica Lane PO Box 160, Harmony, PA 16037.
- B. Tennis court surfacing system shall be a flexible option for use over bituminous concrete pavement.
- C. No color finish system shall be approved as an equal that does not contain factory mixed compositions requiring the addition of water only, on the site. The materials shall be delivered to the site in sealed, properly labeled containers.
- D. Colors (up to two (2)) for the surfacing shall be selected by the Owner's Representative from among the manufacturer's standard range of colors. The filler coats shall have the same color as the final finish coat. The filler coats shall provide uniformity of texture and depth of color to provide a non-slippery and non-shining playing surface of uniform color for not less than three years of intensive use as a recreational surface.
- E. The manufacturer shall guarantee the material for one year from date of finished application against chalking, checking, fading, discoloration, or other adverse effects from ultraviolet rays of the sun; from weather moisture, or from weather temperatures. The Contractor and the manufacturer shall provide jointly such written assurances as are satisfactory to the Owner's Representative that their materials and application will provide this performance.

PART 3 – EXECUTION

4.01 COURT SURFACING INSTALLATION

- A. Final Surface Inspection. Prior to surfacing, the bituminous concrete pavement shall be allowed to cure for a minimum of 14 days. The surface shall be flooded with water and allowed to drain. Any depressions holding water deeper than 1/16 in. shall be adjusted and leveled in accordance with recommendations of the manufacturer of the surfacing material specified hereinafter. Start of color surfacing application shall constitute acceptance of the surface to receive color surfacing.
- B. Application of the color finish course shall occur only after the surface is thoroughly dry. The color finish material shall be applied to the surface course areas in multiple applications in the selected and approved colors as selected by the Owner's Representative so as to form a true, uniform surface texture and color. Application work shall be performed by skilled mechanics in a workmanlike manner in accordance with the manufacturer's standard printed instructions; however, no work shall be performed when rain is imminent or when the temperature is below 55 degrees F.

- C. Apply multiple Filler Coats in accordance with the manufacturer's directions for a total thickness of 1/16 in. If the surface is not covered to a uniform, even texture, free of all porosity, another filler coat shall be applied to attain uniformity. The first coat shall be applied lengthwise on the surface, and the second coat, crosswise. Dilution rate shall not exceed 1 part water to 2 parts Filler Coat.
- D. Prior to applying the Finish Coat, a final, careful inspection of the entire surface shall be made to remove any ridges, loose, or foreign particles.
- E. Finish Coat shall be squeegee applied as directed by the manufacturer at a rate of not less than 0.04 gallons of material per square yard (30 gallons per 800 square yards). The application shall be made lengthwise on the surface and shall produce a uniform color throughout when viewed from a distance of 25 ft. from any edge of the court at midday. Dilution rate shall not exceed 1 part water to 1 part Finish Coat.

4.02 TENNIS COURT LINES

- A. Tennis court playing lines shall not be more than 2" wide, accurately located and marked in accordance with the United States Tennis Association (USTA). At no time shall the playing lines vary more than 1/4" from exact dimensions.
- B. In addition to the 78 foot tennis court lines, each tennis court shall have two (2) pickle ball courts painted dark gray, totaling ten (12) pickle ball courts. Refer to the Drawings for the layouts of these courts.

END OF SECTION

SECTION 32 31 13
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 and gates.
2. Swing Gates (non-fence)
3. Bollards

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for cast-in-place concrete for equipment bases/pads for gate operators and controls and post footings.
2. Division 26 Sections for electrical service and connections for motor operators, controls, limit and disconnect switches, and safety features and for system disconnect switches.

1.3 PERFORMANCE REQUIREMENTS

- a. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.
4. Swing Gates (non-fence)
5. Bollards

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

1.5 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review required testing, inspecting, and certifying procedures.
 - 2. Coordination of new fencing installation and removal of existing fencing.

1.6 PROJECT 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.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer/Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire Fabric: Wire with a diameter of 0.192 inch (6 gauge).
 - a. Mesh Size: 2 inches.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
 - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - 3. Selvage: Twisted top and knuckled bottom.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 - 1. Fence Height: As indicated on Drawings.

2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 4.0 inches.
 - b. End, Corner and Pull Post: 4.0 inches.
3. Horizontal Framework Members: Top and bottom rails complying with ASTM F 1043, 1 5/8 inch diameter.
4. Brace Rails: Comply with ASTM F 1043, 1 5/8 inch diameter.
5. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M.

2.3 GATES

- A. General: Comply with ASTM F 900 for gate posts and single swing gate types.
 1. Gate Leaf Width: As indicated.
 2. Gate Fabric Height: As indicated.
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 2. Gate Posts: Round tubular steel.
 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded.
- D. Hardware:
 1. Hinges: 180-degree inward swing.
 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 3. Padlock and Chain: Owner will provide locks.
 4. Lock: Closer: Manufacturer's standard.

2.4 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Rail and Brace Ends: For each gate, corner, pull, and end post.
- C. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Round-steel tubing not less than 6 inches long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails in the fence line-to-line posts.

- D. Tension and Brace Bands: Pressed steel.
- E. 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.
- F. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- G. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.106-inch; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- H. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.5 GROUT AND ANCHORING CEMENT

- A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable 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.

2.6 Swing Gates (non-fence)

- A. Steel pipe gates painted yellow as shown on plans.

2.7 Bollards

- A. As shown on plans.

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 Architect/Engineer/Construction Manager.

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 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. 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.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet o.c.

E. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. 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.

F. Bottom Rails: Install and secure to posts with fittings.

G. Chain-Link Fabric: Prior to placing fabric, excavate trench for placement of fence anchoring concrete. Apply fabric to outside of enclosing framework. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released. Pour anchoring concrete as shown on the plans embedding 3-inches of the fabric in the concrete.

H. 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.

- I. 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 per ASTM F 626. 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.
- J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 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 and lubricate where necessary.

3.6 FIELD QUALITY CONTROL

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, gate operator, and other moving parts.

END OF SECTION 32 3113

**SECTION 32 31 13.10
CHAIN LINK FENCES AND GATES**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS, which are hereby, made a part of this Sections of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK

- A. Work Included: Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:
 - 1. Chain Link Fence Framework
 - 2. Chain Link Fence Fabric
 - 3. Chain Link Fence Single and Double Swing Gates
 - 4. Chain Link Fence Backstop
 - 5. Cantilever Gate
 - 6. Fence Guard
 - 7. Windscreen

1.03 RELATED WORK

- A. Site Preparation
- B. Earthmoving
- C. Cast-in-Place Concrete
- D. Athletic Ball Netting Systems

1.04 REFERENCES

- A. Work shall conform to codes and standards of the following:
 - 1. ASTM – American Society of Testing Materials
 - 2. State of Delaware Department of Transportation Standard Specifications for Road

and Bridge Construction.

1.05 LAWS, ORDINANCES, PERMITS AND FEES

A. The Contractor shall:

1. Give necessary notices, obtain all permits and pay all Government taxes, fees and other costs in connection with this work, file all necessary plans, prepare documents and obtain all necessary approvals of the local Building Departments having jurisdiction.
2. Obtain all required certificates of inspection for this work and deliver same to Owner’s Representative before request for acceptance and final payment for the work.
3. Include in the work, with no additional cost to the Owner, labor, materials, services, apparatus, drawings (in addition to the Contract Drawings and Documents) in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the Drawings and/or specified.

1.06 QUALITY ASSURANCE

- A. Source: For each type of product required for the work of this Section, provide products of one manufacturer and source for consistency.
- B. Codes and Standards: Perform site improvement work in compliance with applicable requirements governing authorities having jurisdiction. Workmanship and finish shall be equal to the best practice of modern shops for each item of work.
- C. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performances of the work of this Section.
- D. The work of this Section shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades that adjoin materials of this Section before installing items specified.

1.07 SUBMITTALS

- A. Shop Drawings: Supply shop drawings at an approved scale for location, installation and erection of all parts of the work under this Section including but not limited to the following:
 1. Chain Link Fence Framework
 2. Chain Link Fence Fabric

3. Chain Link Fence Single and Double Swing Gates
 4. Cantilever Gate
 5. Chain Link Fence Backstop
- B. Product Information: Provide manufacturer’s data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation. Work includes but is not limited to the following items:
1. Chain Link Fence Framework
 2. Chain Link Fence Fabric
 3. Chain Link Fence Single and Double Swing Gates
 4. Chain Link Fence Backstop
 5. Cantilever Gate
 6. Fence Guard
 7. Windscreen
- C. Material Selection and Samples: Submit samples showing the complete range of colors, textures and finishes available for all components required for construction. Work includes but is not limited to the following:
1. Provide a 12” x 12” sample of fence fabric
 2. Provide a 12” section of each type of fence or gate pipe required

PART 2 - PRODUCTS

2.01 CHAIN LINK FENCE AND GATES

- A. The types of fencing required for the project are as indicated below, subject to detailed material requirements which follow.
- B. All fencing materials shall be black.
- C. All material shall be new, and products of recognized reputable manufacturers. Used, re-rolled or re-galvanized materials are not acceptable.
- D. Like items of materials provided hereinafter shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance and replacement.
- E. Fencing Fabric Wire shall conform to the following:
 1. Fabric shall be premium grade helically wound and woven steel core wire in accordance with ASTM F668 for Class 2B vinyl fabric. Color to be black.
 2. Material specifics shall be as follows:

	Core (inches)	Wire (gauge)	Zinc (oz/S.F.)	Mesh Size
Chain Link Fence (Backstops)	0.192	6	.30	1-3/4"
Chain Link Fence (Athletic Fields)	0.148	9	.30	1-1/4"
Chain Link Fence (General Site)	0.148	9	.30	2"

3. Selvages: Fence fabric shall be knuckled selvage at top and bottom.

F. Powder coated framework shall be steel pipe – Type II: Cold formed and welded steel pipe complying with ASTM F 1043 , Group IC, with minimum yield strength of 50,000 psi (344 MPa), sizes as indicated. Protective coating per ASTM F 1043, external coating Type B, zinc with organic overcoat, 0.9 oz/S.F. (275 g/m²) minimum zinc coating with chromate conversion coating and verifiable polymer film. Internal coating Type B, minimum 0.9 oz/S.F. (275 g/m²) zinc or Type D, zinc pigmented, 81% nominal coating, minimum 3 mils (0.08 mm) thick. Color to be black.

1. Schedule of pipe sizes shall be as follows:

Application	Height (feet)	Outside Dimensions (inches)	Weight (lbs/foot)
Terminal / Corner Posts	6' or less	2.375	3.67
	+6ft – 8ft	2.875	4.64
	+8ft – 12ft	4.00	9.11
	+12ft – 30ft	6.625	19.92
Line Post	6ft or less	1.90	2.28
	+6ft – 8ft	2.375	3.12
	+8ft – 12ft	2.875	4.64
	+12ft – 30ft	6.625	19.92
Rails and Braces	(all heights)	1.66	1.84

2. Post tops shall be provided with post caps which fit securely and exclude moisture.

3. Top Rails shall have lengths no less than eighteen feet (18'-0") and shall be fitted with minimum six inches (6") long outside sleeved or internally swaged couplings for connecting the lengths into a continuous run. Provide top rail with pass-through fittings at line posts and rail end cups and brace bands at terminal or gate posts.

4. Middle and Bottom Rails shall be properly secured to line posts with steel boulevard clamps, and to terminal, corner, gate or pull posts with rail end cups and brace bands.

5. Brace Rails shall be provided for each terminal post with fabric height of six feet or more. Extend brace to each adjacent post at approximate mid-height of fabric and secure with rail end cups and brace bands.

G. Fence fittings and accessories shall be fabricated of steel or cast iron and shall conform to minimum requirements of ASTM F-626, and as below. Following fabrication and

galvanizing, all fence fittings shall receive a 10 to 14 mil thick fusion bonded vinyl coating to match fabric color. With the exception of field painting for nuts and bolts, no painted fittings will be accepted.

1. Stretcher Bars shall not be less than three sixteenth's (3/16") of an inch by three quarter's of an inch (3/4") and not less than 2 inches shorter than the nominal height of the fabric with which they are to be used. One stretcher bar shall be provided for each end and gate post, and two for each corner and pull post.
2. Fabric connectors shall be provided in sufficient number for attaching the fabric to all line posts at intervals not exceeding twelve inches (12"); and not exceeding twelve inches (12") when attaching fabric to top or bottom rail. Connectors shall be galvanized with a min. 0.8 oz/S.F. coating of zinc.
3. Unless designated otherwise on the details, tie wires shall be fabricated from rolled 9 gauge wire stock which has been cut to required lengths for hand-twisted connections at the site. Color to be black.
4. Tension Bands shall be provided in sufficient number for attaching the fabric and stretcher bars to all terminal posts at intervals not exceeding twelve inches (12"). Tension bands shall have a minimum thickness after galvanizing of 0.078 inch; and minimum width of three quarters of an inch (3/4") for posts four inches (4") O.D. or less; and 0.108 inch thickness by seven eighths of an inch (7/8") for posts larger than four inches (4") O.D. Brace bands shall be formed from flat or beveled steel and shall have a minimum thickness of 0.108 inch after galvanizing; and a minimum width of three quarters of an inch (3/4"). Attachment bolts shall be five sixteenths of an inch (5/16") by one and one quarter of an inch (1 1/4") galvanized carriage bolts with nuts, ASTM A-307, Grade A.
5. Other hardware required shall be fabricated from steel, and galvanized in accordance with ASTM A123 and/or ASTM A153.

H. Chain Link Swing Gates:

1. Fabricate chain link swing gates in accordance with ASTM F 900 using galvanizing two inch (2") steel tubular members weighing 2.60 lb/ft. Fusion or stainless steel welded connections forming rigid one-piece unit. Frames shall be thermally fused after fabrication with minimum 10 mils per ASTM 1043. Coating before fabrication will not be allowed.
2. Chain link fabric for gates shall match fabric or fencing.
3. Gate posts shall be steel pipe – type II finished to match fence posts:

Double Leaf Gates	Post Size (inches)	Weight (lb/ft.)
8ft wide or less	2.875	5.79
Greater than 8ft wide	4.00	9.11

4. Gate hinges shall be heavy-duty offset type. Install gate for 180-degree outward operation. Hinges shall have large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by the person.
5. All gate hinge posts shall be terminal posts.
6. All gates shall be equipped with a positive closure latch and padlock fitting.
7. Double gates shall be equipped with a drop rod to hold the inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes

as an integral part of the latch, requiring one pad lock for locking both leaves.

2.02 CANTILEVER GATE

A. Cantilever gates shall be single and double cantilever slide gates with all materials powder coated black. Refer to Drawings for style, quantity, and locations.

B. Fencing Fabric Wire shall conform to the following:

1. Fabric shall be premium grade helically wound and woven steel core wire in accordance with ASTM F668 for Class 2B vinyl fabric. Color to be black.
2. Material specifics shall be as follows:

	Core (inches)	Wire (gauge)	Zinc (oz/S.F.)	Mesh Size
Chain Link Fence	0.148	9	.30	1-1/4"

3. Selvages: Fence fabric shall be knuckled selvage at top and bottom.

C. Cantilever gates shall be as detailed per approved Shop Drawings.

2.03 FENCE GUARD

A. Fence Guard shall be furnished and installed at all new Baseball and Softball Fencing. Refer to Drawings and Details.

B. Fence Guard shall include the following:

1. Fence Guard shall be 5 1/12" high x 2 3/4" wide coming in 8' long sections and be equivalent to Safety Top Cap as manufactured by Pexco Athol of Athol, MA, 800-755-7528.
2. Color to be white in fair territory at Softball; Yellow in fair territory at Baseball. Color shall be black everywhere else.

2.04 FENCE WINDSCREEN

A. Windscreens shall be vinyl coated polyester mesh windscreen, Model VCP6DG as manufactured by Sportsfield Specialties, Inc., 41155 State Highway 10, Delhi, NY 13753, (607) 746-1460.

B. Height of windscreens shall be custom, as described in the Project Drawings.

C. Color to be selected by Owner from manufacturer's standard colors.

D. Gate panels shall have individual sections of windscreen.

E. Windscreen shall receive custom printed graphics. Contractor shall carry costs for printed graphics on 25% of the proposed Windscreen. Graphic files will be provided to the Contractor upon request.

PART 3 EXECUTION**3.01 CHAIN LINK FENCE AND GATES**

- i. General: Unless modified herein, installation of fencing shall meet the requirements of ASTM F567. Erect fencing in straight lines between angle points by skilled mechanics experienced in this type of construction.
- ii. Post Holes: Post holes for line posts shall be excavated to a minimum size of fifteen inches by sixty inches (15"x60"). For fences six feet (6'-0") and taller post holes shall be excavated to a minimum size of eighteen inches by forty-eight inches (18"x48"). Post holes for terminal or gate posts shall have a minimum diameter of eighteen inches (18"), by respective depths as specified.
 1. Backfill concrete to within six inches (6") of finished grade and crown top to shed water.
 2. Set posts and sleeves with plumb vertical alignment.
- iii. Space posts in the fence line equally with the maximum spacing shown on Drawings.
- iv. Provide corner or pull posts at maximum intervals of two-hundred fifty feet (250'-0") O.C., and for any change in direction of 15-degrees or more, and for any abrupt change in grade, with bracing in both directions.
- v. Hanging Fabric:
 1. Fasten chain link fence fabric to terminal posts, and gate posts with tension bars and connector bands.
 2. Fasten chain link fence fabric on field / track side.
 3. Fence fabric shall be secured to all rails and to posts that are not terminal, or gate with wire ties at specified spacing. Tie down wire shall be woven through the fence fabric, completely around the rail and wire shall be twisted securely with three twists on the rail side of the fence and the tails of the wire cut off to preclude untwisting by hand. Twisted tie wire ends shall be turned under at horizontal rails and turned down at vertical rails to reduce potential for human contact.
 4. Stretch fabric as tightly as possible without pulling the material out of shape. Top of fabric shall be parallel with top rail.
- vi. Testing of Fence Fabric: Each fence panel shall be constructed such that it will pass the following test. Deflection of fence fabric shall be no greater than 2 inches (2") when a force of 30 pounds is applied in the center of the panel, perpendicular to the plane of the fence fabric. Fabric shall return to original position when force is released.
- vii. Gates: Install gates in conformance with specification and detail requirements. Test swing and latch and adjust as necessary for proper operation.

END OF SECTION

**SECTION 33 10 00
WATER DISTRIBUTION****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. Artesian Water Company (Artesian) Standard Specifications.

1.2 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service, fire-service mains and combined water service and fire-service mains.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of Artesian. Include tapping of water mains and backflow prevention.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping 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.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

1.6 PROJECT CONDITIONS

- 1. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner without permission of Owner or Construction Manager.

1.7 COORDINATION

- A. Coordinate connection to water main with owner/Artesian.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. All water piping and joints shall be as shown on the plans and in accordance with the Artesian Standard Specifications.

2.2 GATE VALVES

- A. All gates are in accordance with the Artesian Standard Specifications.

2.3 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies are in accordance with the Artesian Standard Specifications.
 - a. Valve Boxes are in accordance with the Artesian Standard Specifications.

2.4 FIRE HYDRANTS

- A. All fire hydrants shall be in accordance with Artesian Standard Specifications.

2.5 FIRE DEPARTMENT CONNECTIONS

- A. Fire Department Connections shall be shown on the plans and in accordance with the Artesian Standard Specifications.:

2.6 METER PIT

- A. Meter Pits shall be as shown on the plans and in accordance with Artesian Standard Specifications.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Water-Main Connection shall be in accordance with the Artesian Standard Specifications.

3.3 JOINT CONSTRUCTION

- A. Make pipe joints in accordance with the Artesian Standard Specifications.

3.4 VALVE INSTALLATION

- A. Install valves in accordance with the Artesian Standard Specifications.

3.5 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position in accordance with the Artesian Standard Specifications..

3.6 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install in accordance with manufacture's recommendations and as shown on the plans..
- B. Install protective pipe bollards on two sides of each fire department connection. Pipe bollards are in accordance with the State of Delaware Fire Marshal requirements.

3.7 Meter Pit

- A. Install in accordance with the plans and the Artesian Standard Specifications.

3.8 CONNECTIONS

- A. Piping installation requirements are specified in other Division 33 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water-distribution piping to existing water main as shown on the plans.

3.9 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Test in accordance with the Artesian Standard Specifications.

3.10 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

3.11 CLEANING

- A. Clean and disinfect water-distribution piping in accordance with the Artesian Standard Specifications.

END OF SECTION 33 10 00

SECTION 22 13 13
FACILITY SANITARY SEWERS

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. Pipe and fittings.
2. Nonpressure couplings.
3. Cleanouts.
4. Encasement for piping.
5. Manholes.
6. Grease Traps
7. Pressure Pipe, fittings and couplings
8. Pump Station

- B. New Castle County Department of Public Works (NCCDPW) Standard Specifications.

1.3 SUBMITTALS

- A. Product Data: For the following:

1. Pipe and Fittings.
2. Cleanouts.
3. Manholes.
4. Pump Station

- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers. For Pump station, include all elevations, pump curves, electrical and wet well.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes and grease trap according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - 2. Contractor must limit disruption of service to no more than four (4) hours.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING AND FITTINGS

- A. All sanitary sewer pipe and fittings shall be as shown on the plans and in accordance with the NCCDPW Standard Specifications.

2.2 CLEANOUTS

- A. PVC Cleanouts:
 - 1. All cleanouts shall be as shown on the plans and in accordance with the NCCDPW Standard Specifications.

2.3 MANHOLES

- A. Standard Precast Concrete Manholes:
 - 1. Sanitary sewer manholes are as shown on the plans and in accordance with the NCCDPW Standard Specifications.
- B. Manhole Frames and Covers:
 - 1. As shown on the plans and in accordance with the NCCDPW Standard Specifications

2.4 Pump Station

- A. All components shall be in accordance with the plans and the NCCDPW Standard Specifications.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, non-pressure, drainage piping according to the manufacture's recommendations.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated in accordance with manufacture's recommendations.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 Pump Station

- A. Install per plans.

3.7 CONNECTIONS

- A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.

1. Make branch connections from side into existing piping to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
2. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects in accordance with NCCDPW Standard Specifications.
- C. Test pump station in accordance with plans and NCCDPW Standard Specifications.

3.10 CLEANING

- A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 33 30 00

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SECTION 33 40 10
ATHLETIC STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 00 00 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.
- D. Provide all facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this section, and as shown on the Drawings

1.02 WORK INCLUDED

- A. Athletic field storm drainage piping, fittings and accessories, and bedding
- B. Infilled synthetic turf underdrain system
- C. Channel and Slot Drains
- D. Cleanouts
- E. Track Drainage Manholes

1.03 RELATED WORK UNDER OTHER SECTIONS

- A. Carefully examine all of the Contract Documents for requirements which affect the work in this section. Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Cast-in-place Concrete
 - 2. Bituminous Concrete Paving
 - 3. Infilled Synthetic Turf System
 - 4. Resilient Track Surface

1.04 REFERENCES

- A. References herein to any technical society, organization, group or body are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable:
 - 1. ASTM American Society for Testing and Materials
 - 2. ACI American Concrete Institute
 - 3. ANSI American National Standards Institute
 - 4. AASHTO American Association of State Highway and Transportation Officials
 - 5. The State of Delaware Department of Transportation Standard Specifications for Road and Bridge Construction
- B. All work shall comply with the pertinent standards of the latest editions of the following Codes and Specifications, unless designated otherwise herein:
 - 1. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19101.
 - 2. American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.

3. American Association of State Highway and Transportation Officials (AASHTO), 341 National Press Building, Washington, D.C. 20004.

C. The following standards and definitions are applicable to the work of this Section to the extent referenced herein:

1. ASTM A48 Standard Specification for Gray Iron Castings
2. ASTM C32 Standard Specification for Sewer and Manhole Brick
3. ASTM C55 Standard Specification for Concrete Brick
4. ASTM C62 Standard Specification for Building Brick
5. ASTM C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM C139 Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
7. ASTM C270 Standard Specification for Mortar for Unit Masonry
8. ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.
9. ASTM C 478 Standard Specification for Precast Reinforced Concrete Manhole Sections
10. ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
11. ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10 lb. (4.54 kg) Rammer and 18 inch (457 mm) Drop.
12. ASTM D2729 Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
13. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
14. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

1.05 SCHEDULING

A. The Contractor shall submit to the Landscape Architect/Civil Engineer, for approval by the Owner, a progress schedule as specified in the GENERAL CONDITIONS. All schedules shall be reviewed by the Contractor with the Owner for compliance with street opening and Town Engineering Department requirements.

1.06 SUBMITTALS FOR REVIEW

A. Product Data: Provide data indicating pipe and pipe accessories, manholes, catch basins, outlet control structures, clean-outs, frames, grates and covers, and all other pertinent information and equipment to be used.

1.07 SUBMITTALS FOR INFORMATION

A. Manufacturer’s Instructions: Indicate special procedures required to install products specified.

B. Certificates: Certify that products meet or exceed specified requirements.

1.08 SUBMITTALS AT PROJECT CLOSEOUT

A. Accurately record actual locations, both horizontally and vertically, of pipe runs, connections, catch basins, all manholes, stormwater treatment system structures,

stormwater detention/recharge systems, and other stormwater infrastructure.

- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.09 REGULATORY REQUIREMENTS

- A. All work under this Section of the Specifications shall be installed in accordance with the Laws, Ordinances, Rules and Regulations of all Local, State and Federal authorities having jurisdiction, the Rules and Regulations of the National Board of Fire Underwriters, and the Public Utility Companies.

1.10 COORDINATION

- A. Coordinate work under provisions of the applicable Sections of these Specifications.

1.11 EXAMINATION OF CONDITIONS

- A. The Contractor shall fully inform himself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in the GENERAL CONDITIONS.

1.12 DELIVERY, STORAGE AND HANDLING

- A. All materials furnished under this section shall be delivered to the job adequately protected from damage during transit. Pipes shall not be dropped. All pipes shall be examined before laying and no piece shall be installed which is found to be defective.
- B. Pipe and other appurtenances, which are defective from any cause, including damage caused by handling, and determined by the Engineer irreparable shall be unacceptable for installation and shall be replaced at no cost to the Owner.
- C. Storage and handling of pipes, pre-cast structures and other storm drainage appurtenances shall be in accordance with the manufacturer's recommendations, subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.01 ATHLETIC FIELD STORM DRAIN PIPE MATERIALS

- A. High Density Corrugated Polyethylene Pipe: Pipe shall have a full circular cross section with an outer corrugated pipe wall and a smooth inner wall. Pipe shall be Hancor “HI-Q” pipe, ADS N-12, Prinsco “Goldflo” dual-wall pipe, or approved equal. Pipe manufactured for this specification shall comply with the requirements for test methods, dimensions and markings found in AASHTO Designations M252, and M294. Pipe shall be made from virgin PE compounds which conform to the applicable current edition of the AASHTO Material Specifications for cell classification as defined and described in ASTM D 3350.

- 1. Joints and Fittings: Standard 45 Degree “Y” connections, tees, bends, and other fittings shall be fabricated to sizes shown on the drawings. Coupling Bands shall be per manufacturer’s specifications. Couplers shall cover not less than one corrugation on each section of pipe. Fittings shall be made from virgin PE

compounds which conform to the applicable current edition of the AASHTO Material Specifications for cell classification as defined and described in ASTM D 3350.

- 2.02 FLAT PANEL DRAIN PIPES (WITHIN INFILLED SYNTHETIC TURF SYSTEM PROFILE)
- A. Flat Panel Drains shall be perforated pipes equivalent to the 12” AdvanEDGE pipe by ADS-Pipe, the 12” Multi-Flow drain by Multi-Flow Drain Systems, or approved equal.
 - 1. All fabric shall be removed from the pipes prior to installation.
 - 2. All fittings and couplings shall be manufactured by the same approved manufacturer to ensure proper connections between systems.
- 2.03 CHANNEL DRAIN – TYPE 1 (NEUTRAL)
- A. Channel drain around the inside edge of the track shall be ACO Sport Model 4030 (12.26” depth) Channel Drain System as manufactured by ACO Polymer Products, or approved equal. It is intended that the channel drain is neutral.
 - B. The channel drain system bodies shall be manufactured from polymer concrete minimum properties as follows:
 - 1. Compressive strength: 14,000psi.
 - 2. Flexural strength: 3,000psi.
 - 3. Water absorption: 0.1%
 - C. Channel Profile shall include positive interlocking tongue and groove connections that can be sealed to provide watertight connections. Each pre-cast polymer concrete one meter unit shall be an open U-shaped channel to accept a grate 4.84” wide.
 - D. Grates shall be ADA black plastic, polypropylene, as manufactured by ACO Polymer Products, or approved equal.
 - E. Channel drain in-line catch basins shall be Part No. 05620 as manufactured by ACO Polymer Products, or approved equal.
- 2.04 SLOT DRAIN
- A. Slot Drain shall be System 2000 Channels Part 00784 (straight) and Part 00786 (radius) as manufactured by ACO Polymer Products, or approved equal.
 - B. The slot drain system bodies shall be manufactured from polymer concrete minimum properties as follows:
 - 1. Compressive strength: 14,000psi.
 - 2. Flexural Strength: 3,000psi.
 - C. Channel Profile shall include positive interlocking tongue and groove connections that can be sealed to provide watertight connections. Each pre-cast polymer concrete one meter unit shall have a 0.5” longitudinal evacuation slot.
 - D. Slot drain in-line catch basins shall be Part No. 05620 as manufactured by ACO Polymer Products, or approved equal.
- 2.05 CHANNEL DRAIN – TYPE 2 (SLOPED)
- A. Channel drain in front of the varsity baseball and softball dugouts shall be ACO Sport Model 4000 Channel Drain System as manufactured by ACO Polymer Products, or approved equal. It is intended that the channel drain utilize both neutral and sloped bodies.

- B. The channel drain system bodies shall be manufactured from polymer concrete minimum properties as follows:
 - 1. Compressive strength: 14,000psi.
 - 2. Flexural strength: 3,000psi.
 - 3. Water absorption: 0.1%
- C. Channel Profile shall include positive interlocking tongue and groove connections that can be sealed to provide watertight connections. Each pre-cast polymer concrete one meter unit shall be an open U-shaped channel to accept a grate 4.84" wide.
- D. Grates shall be ADA black plastic, polypropylene, as manufactured by ACO Polymer Products, or approved equal.
 - 1. Channel drain in-line catch basins shall be Part No. 05620 as manufactured by ACO Polymer Products, or approved equal.

2.06 CLEANOUT

- A. Cast iron frames and covers shall conform to ASTM A48, latest issue, Class 30.
 - 1. Provide concrete collars as shown on the Drawings

2.07 TRACK DRAINAGE MANHOLES

- A. Track Drainage Manholes shall be equivalent to the 12" Nyloplast Custom Drain Basin by ADS-Pipe.
 - 1. Each basin shall have a 24" sump below the outlet invert.
 - 2. Provide a round ductile solid iron cover meeting H-20 load requirements.
 - 3. Provide a concrete collar at all basins.

2.08 BEDDING AND COVER MATERIALS

- A. Bedding: Crushed stone as specified in Section EARTHWORK.
- B. Cover: Gravel as specified in Section EARTHWORK.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The bedding for the Pipe shall be shaped to conform reasonably close to the lower 10% of the pipe and recesses excavated for bells of bell and spigot pipes. All pipe shall be laid to the specified line and grade, with a firm bearing throughout each length and with bell ends uphill.
- B. Drainage pipe shall be backfilled with gravel having no stone greater than 3 inches unless otherwise noted on plans.
- C. The joint of reinforced concrete pipe shall be thoroughly cleaned and wetted with water before being joined. Reinforced concrete pipe shall be joined using a flexible water tight rubber gasket conforming to ASTM C443 and the filling the joint be completed with cement mortar. Any alternative joint design must be pre-approved by the Landscape Architect/Civil Engineer. The invert shall be kept smooth and free of obstructions.
- D. The drain trench shall be excavated to the depth designated on the plans or, if directed, to a stratum of impervious material.
- E. The excavation shall proceed in advance of the actual drain construction only to the extent the Landscape Architect/Civil Engineer direct.
- F. Where rock is encountered in the excavation, no part of any rock remaining in the trench shall come within six inches of any portion of the pipe.

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- G. Joints shall be grouted or sealed when using reinforced concrete pipe and corrugated plastic pipe shall be firmly joined with an approved coupling.
- H. The Contractor shall be responsible for keeping the backfill material clean and free of objectionable material from a line one inch below the flow line of the pipe to the top of the trench.
- I. Existing drainage infrastructure is to be field cored with the proper equipment approved and satisfactory to the Landscape Architect/Civil Engineer. Contractor shall confirm the invert of the proposed tie-in prior to beginning drainage excavations.
- J. Removal and disposal of the existing drain pipe within the trenching area of proposed pipe shall be included in contract unit price per foot of kind of pipe at no additional compensation to the Contractor.
- K. Removal and disposal of the existing drain pipe outside of the trenching area of proposed pipe shall be excavated and completely removed then backfilled and compacted with the proper material.

3.02 EXAMINATION

- A. Verify that trench cut and excavation base is ready to receive work and excavations, dimensions and elevations are as indicated on drawings.

3.03 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with coarse aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.04 BEDDING

- A. Excavate pipe trench in accordance with Section 02200 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.05 INSTALLATION - PIPE

- A. Install pipe, fittings and accessories in accordance with applicable standards and manufacturer's instructions. Seal joints watertight.
- B. Place pipe on bedding to depths indicated on drawings. Notch under pipe bells and joints, where applicable to provide for uniform bearing under entire length of pipe.
- C. Lay pipe to slope gradients noted on drawings with maximum variation from true slopes of 1/8 inch per foot.
- D. Install bedding at sides and over top of pipe. Provide top cover to minimum compacted thickness as indicated on drawings. Compact to 95%.
- E. Refer to EARTHWORK Section for trenching, bedding, backfilling and compaction requirements. Do not displace or damage pipe when compacting.

3.06 INSTALLATION - SYNTHETIC TURF FIELD UNDERDRAINS

- A. Underdrains shall be installed in accordance with the details on the Contract Drawings and the manufacturer's instructions and recommendations

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- B. Reminder to remove all fabric from the pipes prior to installation.

3.07 CHANNEL DRAINS AND SLOT DRAINS

- A. Channel drains, grates, and in-line catch basins shall be installed in accordance with the details on the Contract Drawings and the manufacturer's instructions and recommendations.
- B. Where the channel drain transitions to a slot drain, there shall be an in-line catch basin and the top elevation of the slot drain shall be ½" lower than the top elevation of the channel drain. Refer to drawings for locations of additional in-line catch basins and drain elevations.
- C. The top elevations of the channel drains shall be uniform and as indicated on the Drawings. Prior to encasing the channel drains with concrete, Contractor shall provide to the Landscape Architect/Civil Engineer a shop drawing for review providing spot elevations every 39.37" (at the joint where the channel drain and slot drains meet. Any channel drain drains out of tolerance to the design grade shall be modified prior to encasing with concrete.

3.08 CLEANOUTS

- A. Cleanouts shall be installed in accordance with the details on the Contract Drawings and the manufacturer's instructions and recommendations.

3.09 CLEANING

- A. At the completion of the work, clean all piping, structures, as well as open drainage courses through and to which water from this construction is directed to the satisfaction of the Landscape Architect/Civil Engineer.

3.10 PROTECTION

- A. Protect finished work under provisions of applicable sections of these specifications.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 00
STORM UTILITY DRAINAGE PIPING

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. Pipe and fittings.
2. Nonpressure transition couplings.
3. Expansion joints and deflection fittings.
4. Drains.
5. Encasement for piping.
6. Manholes.
7. Channel drainage systems.
8. Catch basins.
9. Stormwater inlets.
10. Stormwater detention structures.
11. Pipe outlets.
12. Stormwater disposal systems.
13. Stormwater Management Facilities

- B. Delaware Department of Transportation (DelDOT) Standard Specifications.

- C. Delaware Department of Natural Resources and Environmental Control (DNREC) Sediment and Erosion Control Handbook.

1.3 SUBMITTALS

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

- B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins: Include plans, elevations, sections, details, frames, covers, and grates.
3. Piping: Include manufacturer's certification for each pipe type.
4. Stormwater Management Facility Outlet Structures.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect/Engineer, Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 PIPING

- A. All storm drainage piping shall be as shown on the plans and in accordance with the DeIDOT Standard Specifications.

2.2 MANHOLES

- A. All storm water manholes shall be as shown on the plans and in accordance with the DeIDOT Standard Specifications.

2.3 CATCH BASINS

- A. All catch basins shall be as shown on the plans and in accordance with the DeIDOT Standard specifications.

2.4 STORMWATER MANAGEMENT STRUCTURES

- A. All structures shall be as shown on the plans and in accordance with either the DeIDOT Standard Specifications or the DNREC Erosion and Sediment Control Handbook.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, non-pressure drainage piping according to DelDOT Standard Specifications.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated in accordance with the DelDOT Standard Specifications.

3.5 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated in accordance with the DelDOT Standard Specifications.

3.6 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

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1. Remove manhole or structure and close open ends of remaining piping.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

3.8 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 33 41 00

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**SECTION 33 46 00
SUBDRAINAGE****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. Perforated-wall pipe and fittings.
2. Geotextile filter fabrics.

- B. Delaware Department of Transportation (DelDOT) Standard Specifications.

- C. Delaware Department of Natural Resources and Environmental Control (DNREC) Erosion and Sediment Control Handbook.

1.3 SUBMITTALS

- A. Product Data:

1. Drainage conduits.
2. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:

1. Shall meet the requirements of Advanced Drainage Systems, Inc (ADS) for all pipe sizes or approved equal.

2.2 SOIL MATERIALS

- A. Soil materials are specified in Division 31 Section "Earth Moving."

2.3 GEOTEXTILE FILTER FABRICS

- A. Description: Geotextile fabrics shall meet the requirements of Mirafi 140N or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where sub-drainage systems are to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 4 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Add drainage course to width of at least 4 inches on side away from wall and to top of pipe to perform tests.
- E. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.4 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Lay perforated pipe with perforations down.
 - 2. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

3.5 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to manufacturer's requirements.

3.6 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Division 31 Section "Earth Moving."
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.

3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 - 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00

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