SP, COMPREHENSIVE GRADING

1.0 DESCRIPTION

This item shall include all elements of work covered by the referenced NCDOT Specifications and the numbered Additional City Specifications provided herein.

NCDOT Specifications
200, "Clearing and Grubbing"
225, "Roadway Excavation"
230, "Borrow Excavation"
235, "Embankments"
240, "Ditch Excavation"
250, "Removal of Existing Pavement"
260, "Proof Rolling"
340, "Pipe Removal"
412, "Unclassified Structure Excavation"
416, "Channel Excavation"
500, "Fine Grading, Sub-grade, Shoulders and Ditches"
545, "Incidental Stone Base"
560, "Shoulder Construction"
1530, "Abandon or Remove Utilities"

Additional City Specifications

1. Clearing and Grubbing: Clearing on this Project shall be performed to the slope stake line or the right-of-way or easement lines unless directed otherwise. The Contractor shall remove all trees in the easement areas.

2. Traffic Bearing Road Plates: The Contractor shall be responsible for all traffic bearing road plates needed in accordance with NCDOT Utility Cut Replacement Detail.

3. Fence Removal and Disposal and or Fence Relocation: as shown on the plans and any additional removal or relocation identified by the Contractor's means and methods shall be included in this item.

4. Hedgerow and or Planting Bed Removal and Disposal: as shown on the plans and any additional hedgerow or planting bed removal identified by the Contractor's means and methods shall be included in this item. Hedgerows to be removed shall be approved by the Engineer prior to removal.

5. Mail Boxes and Site Amenities: remove, protect, and reset mail boxes and site amenities. The Contractor shall keep mailboxes in service at all times and allow / provide for other services, including but not limited to trash pickup.

6. Existing Road Signs: remove, protect, and reset road signs. Repair or replace signs damaged in relocating. Erect signs and supports according to requirements of NCDOT Specifications 903 and 904.

7. Removal and Disposal of Existing Infrastructure: concrete curb**,** sidewalk, miscellaneous concrete, asphalt, driveways, pads, slabs, walls, culverts, structures, catch basins, manholes, etc. within the construction limits as shown on the plans and any additional infrastructure removal identified by the Contractor's means and methods, shall be included in this item.

8. Shoring: The Contractor shall be responsible for all shoring to include means, methods, materials and engineering needed to construct the project. Temporary shoring required in NCDOT's ROW will be covered and paid for by this item.

9. Saw Cutting: all saw cutting required to build the Project. Where asphalt or concrete (curb, sidewalk, roadway, driveways, parking lots, etc.) is to be removed, the Contractor shall provide a neat edge along the pavement being retained by sawing the pavement a minimum of 2" deep and 1' wide before breaking and removing adjacent pavement. When the Contractor proposes to saw pavement more than one foot from the proposed pavement (curb, sidewalk, structure, etc.), the Contractor shall obtain approval from the Engineer prior to saw cutting and removing pavement. The cost of sawing asphalt or concrete shall be included in this item.

10. Property Access: All labor and materials required to maintain access to properties during construction as directed by the Engineer.

11. Erosion Control Permit: All costs from EROSION & SEDIMENT CONTROL - FINANCIAL RESPONSIBILITY AND CERTIFICATE OF COVERAGE shall be included in this item.

12. Sidewalk and Curb Clean-up: The Contractor shall have all related sidewalk and curb work completed within ten (10) days of placement, including but not limited to 1) removal and disposal of construction debris; 2) related grading to include fine grading; 3) site restoration; 4) seedbed preparation and dress up work; 5) seeding and mulching; and 6) final cleaning.

13. Tree and/or Stump Removal and Disposal: as shown on the plans and any additional tree and/or stump removal identified by the Contractor's means and methods shall be included in this item. Trees to be removed shall be approved by the Engineer prior to removal.

14. Utility Pipe/Conduit Removal and Disposal: existing public or private utility pipe / conduit, subsurface and shoulder drain pipe removal and disposal as shown on the plans and any additional utility pipe / conduit removal identified by the Contractor's means and methods shall be included in this item.

15. Rock Excavation: all rock excavation required to build the project.

16. Unsuitable Material: Unsuitable soil material that must be hauled off from the site will be pid per the Unit Costs in the Bid Form. Suitable soils are defined as ASTM D 2487 Soil

Classification Groups SM, ML, SC, and CL, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. It is the contractor's responsibility to dry all soils to within 3% of optimum moisture before the determination of suitability is made. Final determination will be at the discretion of the Engineer. The Engineer should be consulted before any material is declared unsuitable and removed from the site.

17. Import Excavation: It is the responsibility of the contractor to verify site grading quantities from the provided drawings and files. Any import excavation required to satisfy the requirements of the grading and drainage plans will be incidental to this line item. No separate payment will be made for any Borrow Excavation or Import Excavation. All clearing, grubbing, and grading activities are incidental to this Comprehensive Grading line item.

18. Erosion Control: includes but is not limited to furnishing, installing, and maintaining, silt fence, diversion ditches, rock inlet sediment traps, rock pipe sediment trap, silt sacks, all stone for erosion control, rock check dams, block and gravel and inlet protection, catch basin inlet protection, temporary rock construction entrances, silt basins, temporary matting and all other erosion control measures required by, the plans, current ordinances, project permitting, and the Contractor's means and methods.

19. Backfill of Asphalt/Concrete: Prior to completion of the project all curb, asphalt, and concrete must be backfilled and fine graded for positive drainage. There will be no separate payment for import excavation required for positive drainage behind asphalt trails, drives, or concrete sidewalks.

2.0 MEASUREMENT

There will be no separate measurement made for Comprehensive Grading.

3.0 PAYMENT

For the above-referenced NCDOT sections and numbered Additional City Specifications, there will be no direct measurement, payment or compensation, all cost incurred to complete the work as specified shall be included in the Lump Sum price bid for "Comprehensive Grading".

There will be **no separate measurement or payment** for the items listed or referenced in this specification.

Payment will be made under:

COMPREHENSIVE GRADING .....LS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work phases.
4. Work under other contracts.
5. Use of premises.
6. Owner's occupancy requirements.
7. Specification formats and conventions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: **Academy Complex Renovations**

1. Project Location: 165 Academy Avenue NW, Concord, NC

B. Owner: **City of Concord, NC**
Owner's Representative: **Rick Blat, Deputy City Engineer**

The work of this contract includes but is not limited to, construction of a synthetic turf multi-purpose field, sports netting, fencing, dugouts, brick backstop, sidewalk, building demolition, new restroom and storage building, two press box renovations, one press box with concessions renovation, one restroom renovation, sports lighting adjustments, soil remediation, and relocated scoreboard all with the associated grading, stormwater infrastructure, utilities, erosion control, and plantings at the Academy Complex, as well as asphalt trail, restroom/concession renovation, and press box renovation at Gibson Field.

1. Contractor shall furnish all material, labor, tools, supplies, equipment, transportation, temporary construction of every nature, insurance, taxes, contributions and all services and facilities, unless specifically excepted, and install all materials, items and equipment required to complete the construction of the Project, as set forth in the Contract.
2. Coordination of owner provided and owner installed equipment. General Contractor shall coordinate all trades with owner’s contractor for these items.
3. The General Contractor shall act as the Project Expediter and be responsible for coordinating the work and schedules of other trades.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 WORK PHASES

1. The Work shall be conducted in one phase. Work of this phase shall be substantially complete and ready for certification of completion within **12 months (365 days)** after the notice to proceed

1.6 USE OF PREMISES

A. All construction activities shall be coordinated with the City of Concord.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to all fill and cut areas associated with the project and generally 10 feet outside of this for constructability.
2. Driveways and Entrances: Keep all construction access and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words

shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012500 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. The bidding contractor shall provide unit prices for the following items. Unit prices are subject to owner review and consideration as part of the overall bid. All unit prices shall remain firm through the initial contract period.

B. Price decreases are acceptable at any time, need not be verifiable, and are required should the contractor/producer/processor/manufacturer experience a decrease in costs associated with the execution of the contract.

C. All unit prices are to be fully inclusive of all expenses including travel, materials and all fees and be the final cost to the owner

D. Should the awarded vendor, at any time during the life of the contract, sell materials of similar quality to another customer, or advertise special discounts or sales, at a price below those quoted within the contract, the lowest discounted prices shall be offered to the owner

E. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

F. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

G. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1

1. Provide a cost per square foot (100sqft) to remove and replace existing damaged roof sheathing with new 1/2" thick OSB per design drawings.

B. Unit Price No. 2

1. Provide a cost per cubic yard to remove unsuitable soils.

C. Unit Price No. 3

1. Provide a cost per cubic yard to supply and place structural fill per geotechnical engineer requirements.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Alternates work, as indicated on the drawings, as specified herein or both. Contractors are responsible for payment of all applicable fees and taxes in association with their contract.

1.2 USE OF ALTERNATES

A. Submit alternate/base bid proposals as described herein and in the "Bid Form" stating the total difference in cost to the stipulated Lump Sum Bid for adding or deducting the following alternates to that specified and/or shown on the drawings.

1. Include all applicable omissions, additions, and adjustments of all other applicable trades as required.

PART 2 - PRODUCTS

2.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Provide a Resilient Underlayment Pad with SBR and Sand Infill and adjust subgrade depth accordingly.

B. Alternate No. 2: Provide a Resilient Underlayment Pad with Organic Wood and Sand Infill and adjust subgrade depth accordingly.

END OF SECTION 012300

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section

1.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities

B. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

C. Temporary utilities include, but are not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating and cooling facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.

D. Support facilities include, but are not limited to, the following:

1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices as required.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Temporary elevator usage.
9. Temporary stairs.
10. Construction aids and miscellaneous services and facilities.

E. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.

4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Temporary enclosures.
9. Temporary partitions.
10. Fire protection.

F. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
2. Division 1, of the Technical Specifications Section "Execution Requirements" for progress cleaning requirements.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Consultant, permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and all openings are closed with permanent construction or substantial temporary enclosures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Consultant and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Consultant.
3. Testing agencies.
4. Personnel of authorities having jurisdiction.
5. Occupants of Project

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

E. Communications: Pay all charge associated with communications.

F. Streets, Sidewalks, and Temporary Easements: Pay all charges associated with the Work where charges will occur.

1.5 SUBMITTALS

A. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.6 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if indicated on the plans and/or specifications. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts**,** with 1-5/8-inch- OD top rails.

C. Portable Chain-Link Fencing: Minimum 2-inch 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

D. Water: Potable.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Prefabricated or Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure and the requirements of the local Governing agency.

D. Self-Contained Toilet Units: Single-occupant units of chemical or aerated recirculation or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. If existing easements can not be used, the Contractor shall consult and coordinate with the Consultant and Owner to secure as necessary to obtain the temporary easement. Add provisions for work not in the Contract but served by temporary facilities if required.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to municipal system or private system indicated as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Subparagraph below may be excessive for small- and medium-size projects.

3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations as required. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
4. Drinking-Water Facilities: Provide drinking-water.

E. Heating and Cooling: Provide temporary heating and cooling as required by construction activities.

F. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear as required.

G. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

H. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.

1. At each telephone, post a list of important telephone numbers in Spanish and English.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Consultant's office.
e. Engineers' offices.
f. Owner Representative’s office.
g. Principal subcontractors' field and home offices.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: If required, Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Maintain support facilities until approved by the Consultant to be removed.

B. Temporary Roads and Paved Areas: If applicable/as needed, construct and maintain temporary roads and paved areas to avoid damage to the site. Locate temporary roads and paved areas in same location as permanent roads and paved areas. If applicable, extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

D. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs. The General Contractor shall provide one construction sign. The construction sign shall be installed within the first two weeks of construction and shall be removed when the project is substantially complete. The sign shall be as follows:

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with “Construction and Demolition Waste Management Recycling.

F. Common-Use Field Office: If required, provide an insulated, weather tight, air-conditioned and heated field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings.

G. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Storm water Control: Comply as indicated on the erosion control plan/measures before any earth disturbing activities start.

C. Tree and Plant Protection: Comply with the plans and specifications for protection.

D. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

G. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

H. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

B. Temporary Facility Changeover: Except for using permanent fire protection as soon as available. Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1, of the Technical Specifications Section "Closeout Procedures."

END OF SECTION 015000

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.
6. Correction of the Work.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1, of the Technical Specifications Section "Submittal Procedures" for submitting surveys.
3. Division 1, of the Technical Specifications Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 1, of the Technical Specifications Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
5. Division 1, of the Technical Specifications Section “Construction Waste Management” method of disposal of construction waste.

1.3 SUBMITTALS

A. Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Consultants and owners, and other information specified.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer as required.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A licensed professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility, Owner, and Consultant that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: 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 Consultant, Owner, adjacent property owners not less than **two** days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Consultant's and Owner's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Consultant. Include a detailed description of problem encountered, together with recommendations for modifications of the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Consultant promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Consultant when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
7. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
8. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
9. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Consultant. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Consultant before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations. Dispose of material accordance to Division 1, Section “Construction Waste Management”.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean surfaces and similar features before applying paint or other finishing materials.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration until Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017000

SECTION 017310 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Selective Demolition" for demolition of selected portions of the building for alterations.
2. Divisions 2 through 16, of the Technical Specifications Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

    a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or those results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.

2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specified firm.

a. Processed concrete finishes.
b. Stonework and stone masonry.
c. Ornamental metal.
d. Roofing.
e. HVAC enclosures, cabinets, or covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of the Technical Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of the Technical Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

END OF SECTION 017310

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project As-Builts Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1, of the Technical Specifications Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.
3. Division 1, of the Technical Specifications Section “Construction Waste Management” method of disposal of construction waste.
4. Division 1, of the Technical Specifications Section "Execution Requirements" for progress cleaning of Project site.
5. Division 1, of the Technical Specifications Section “Project Record Documents”.
6. Division 1, of the Technical Specifications Section “Operation and Maintenance Data”.
7. Divisions 2 through 16, of the Technical Specifications Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: The Contractor shall, before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, “As-Builts” drawings operation and maintenance manuals, Final Completion construction photographs and photographic negatives if required, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Consultant will either proceed with inspection or notify Contractor of unfulfilled requirements. Consultant will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Consultant, that must be completed or corrected before certificate will be issued. The Consultant’s Substantial Completion list is composed by verification of the punch list submitted by the Contractor and any additional defects in the work observed by the Consultant.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1, of the Technical Specifications Section "Payment Procedures."
2. Submit certified copy of Consultant's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Consultant. The certified

copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes if required.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Consultant will either proceed with inspection or notify Contractor of unfulfilled requirements. Consultant will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. The Contactor shall take immediate steps to correct the stated deficiencies, and send a written notice to the Consultant, certifying the Project is complete, at which time the Consultant will re-inspect the Work. This review and additional reviews by the Consultant where the Work is not considered Substantial Completion or Final Completion will be considered an additional service from the Consultant. The Contractor will be charged for these additional services incurred by such failure including travel time, observation time, and administrative time at the Consultant's hourly rate, as well as all expenses associated with the distribution of a written notice stating the reasons for failure to reach final completion.

3. In the event the Contractor is granted Substantial Completion by the Consultant and the Contractor fails to complete and/or correct all of the items listed in the Substantial Completion within **30** calendar days of the date of Substantial Completion, the liquated damages shall start to accrued until all of the items on the Substantial Completion list are completed and/or corrected and have been approved by the Consultant.

4. If the Consultant is required to make more than two inspections for the project to achieve Substantial Completion, the Contractor shall pay for the Consultant's time and expensive.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, use the room number as indicated on the drawings and on the exterior areas include a location diagram indicating the defects.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Consultant.
    d. Name of Contractor.
    e. Page number.

1.6 PROJECT RECORD DOCUMENTS

A. The Contractor shall provide Project Record Documents, O&M, “As-Builts” Drawings, and Warrantees as indicated in Division 1, of the Technical Specifications Section Project Record Documents. Use Division 1, of the Technical Specifications Section "Project Record Documents".

1.7 OPERATION AND MAINTENANCE MANUALS

A. See Section “Operation and Maintenance Manuals” for additional Information.

1.8 **WARRANTIES**

A. Submittal Time: Submit written warranties on request of Consultant for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Provide copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
q. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017810 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. As-Built Drawings in Auto CAD.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications, Section "Closeout Procedures" for general closeout procedures.
2. Division 1, of the Technical Specifications, Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 16, of the Technical Specifications, Sections for specific requirements for Project Record Documents of products in those Sections.

1.3 SUBMITTALS

A. As-Built Drawings: Comply with the following:

1. Number of Copies: Submit two sets of marked-up As-Built Drawings to the Consultant for the Consultant to prepare the Record Drawings.

B. Record Specifications: Submit two copies of Project's marked up Specifications, including addenda and contract modifications.

C. Record Product Data: Submit two copies of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 AS-BUILT DRAWINGS

A. As-Built Drawings: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark As-Built Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up As-Built Drawings.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Consultant's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.
    o. Clarification Drawings.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
7. Identify and date each As-Builts Drawing; include the designation "PROJECT AS-BUILTS DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

B. Newly Prepared As-Built Drawings: Prepare new Drawings instead of preparing As-Built Drawings where Consultant determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting a substitution or other modification.
2. Consult with Consultant for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared As-Built Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, As-Built Drawings, and Product Data where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, As-Built Drawings, and Product Data where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other of the Technical Specifications Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Consultant's reference during normal working hours.

END OF SECTION 017810

SECTION 017820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation and Maintenance manuals for the care and maintenance systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1, of the Technical Specifications Section “Construction Waste Management” method of disposal of construction waste.
3. Division 1, of the Technical Specifications Section "Closeout Procedures" for submitting operation and maintenance manuals.
4. Divisions 2 through 50, of the Technical Specifications Sections for specific operation and maintenance manual requirements for products in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Final Submittal: Submit four copies of each manual in final form at least 15 days before final inspection. Consultant will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Consultant's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Consultant's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation include information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Operations and Maintenance Manuals shall be organized in CSI format.

B. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

C. List of Systems and Subsystems: List systems alphabetically.

D. List of Equipment: List equipment for each system, organized alphabetically by system.

E. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

F. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents.

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page to Include the following information:

1. Name and address of Project.
2. Name and address of Owner.
3. Date of submittal.
4. Name, address, and telephone number of Contractor and Subcontractors.
5. Name and address of Consultant.
6. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, model number, and serial number indexed to the content of the volume, and cross-referenced to of the Technical Specifications Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

Provide both hard copy and digital PDF copy.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary, to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with reinforced tabs for each section. Mark each tab to indicate contents.
3. If provided with the equipment, provide a Protective Plastic Sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch, white bond paper.
5. Drawings: Attach reinforced, punched on drawings and bind in manual with associated text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Content: In addition to requirements in this section, include operation and maintenance data required in individual specification sections include including source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and

service schedules, spare parts list & source information, maintenance service contracts, warranty, and bond information and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. Re-ordering information for parts.
11. Standard printed maintenance instructions and bulletins.
12. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
13. Identification and nomenclature of parts and components.
14. List of items recommended to be stocked as spare parts.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Routine and normal operating instructions.
3. Regulation and control procedures.
4. Instructions on stopping.
5. Normal shutdown instructions.
6. Seasonal and weekend operating instructions.
7. Required sequences for electric or electronic systems.
8. Special operating instructions and procedures.

D. Warranties and Bonds: Include copies of warranties and bonds for each piece of equipment and lists of circumstances and conditions that would affect validity of warranties or bonds. Also, include the Contractor’s Warranty for the project.

1. Include procedures required for notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

END OF SECTION 017820

SECTION 018200 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 1, of the Technical Specifications Section "Project Management and Coordination" for requirements for pre-instruction conferences.
2. Division 1, of the Technical Specifications Section "Photographic Documentation" for preparing and submitting demonstration and training videotapes.

1.3 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Consultant.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment.

1. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

2. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

3. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

4. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

5. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times.

1. Schedule training with Owner, through Consultant, with at least seven days' advance notice.

C. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 018200

SECTION 023200 – GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This bid documents includes the following geotechnical report prepared by as an appendix to the Project Manual:

1. Subsurface Exploration report prepared by ECS Southeast, LLC

Geotechnical Engineering Report

Academy Complex Renovations

Concord, Cabarrus County, North Carolina

ECS Project No. 08:15911

July 15, 2023

1.2 REPORT AND ANALYSIS

A. All reports are made part of this section enabling the Contractor and all parties in the construction to have the same information available to the Owner and Consultants regarding the subsurface conditions.

B. This information shall not be a substitute for the Contractor's personal investigation or judgment of actual conditions found on site. If the Contractor requires additional subsurface information, it may be obtained at the Contractor's expense with Owner's approval.

C. Variations

1. The nature of variations may not become evident until construction begins. Should subsurface conditions differ significantly from the information in the reports included at the end of this section, the Contractor shall immediately notify the Engineer verbally, followed by a written notification.
2. No charge in the Contract Time or Contract Sum will be considered without an executed Change Order.

D. Regardless of the thoroughness of the geotechnical explorations, possibilities exist that subsurface conditions will differ from those at the boring locations or will not be as anticipated by the design professionals. Therefore, the Owner and the Consulting Engineers assume no responsibility for the accuracy of the information in the geotechnical reports and shall be held harmless for any claims by the Contractor, or others, because of errors in the reports.

END OF SECTION 023200

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following storm water related structures:

1. Outlet structure anti-flotation blocks.
2. Pipe cradles.
3. Pipe collars.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

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

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

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

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

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

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.

5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

1.5 QUALITY ASSURANCE

A. 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 certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. 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.

D. ACI 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."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Mockups: Cast concrete wall panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Build panel approximately 15 sq. ft. in the location indicated or, if not indicated, as directed by Architect.
2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

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

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

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

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

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

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

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, deformed.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports

from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I gray. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C or F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

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

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

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

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

2.7 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products:

a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.

b. Concrete Sealants Inc.; Conseal CS-231.
c. Greenstreak; Swellstop.
d. Henry Company, Sealants Division; Hydro-Flex.
e. JP Specialties, Inc.; Earthshield Type 20.
f. Progress Unlimited, Inc.; Superstop.
g. TCMiraDRI; Mirastop.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edoco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

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

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

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:

a. Burke by Edoco; Cureseal 1315 WB.
b. ChemMasters; Polyseal WB.

c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d. Euclid Chemical Company (The); Super Diamond Clear VOX.
e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h. Meadows, W. R., Inc.; Vocomp-30.
i. Metalcrete Industries; Metcure 30.
j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
k. Tamms Industries, Inc.; LusterSeal WB 300.
l. Unitex; Hydro Seal 25.
m. US Mix Products Company; US Spec Radiance UV-25.
n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 3600 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

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

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

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

1. Fly Ash: 25 percent, for concrete exposed to weather.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

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

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

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. All concrete: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3600 psi at 28 days.
2. Slump Limit: 4 inches, plus or minus 1 inch.
3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch 3/4-inch nominal maximum aggregate size.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M **and ASTM C 1116**, and furnish batch ticket information.

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

PART 3 - EXECUTION

3.1 FORMWORK

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

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

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class C, 1/2 inch for rough-formed finished surfaces permanently concealed.
3. Class D, 1 inch for rough-formed finished surfaces permanently concealed.

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

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

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

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

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

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

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

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

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

3.2 EMBEDDED ITEMS

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

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

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

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

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

3.4 STEEL REINFORCEMENT

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

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

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

3.5 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, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.6 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

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

C. 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.

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 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 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.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

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

3.8 FINISHING FORMED SURFACES

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

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

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

1. Apply to concrete surfaces exposed to public view, to be covered with a coating or covering material applied directly to concrete.

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

3.9 CONCRETE PROTECTING AND CURING

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

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

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

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

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

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

a. Water.
b. Continuous water-fog spray.

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

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

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

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

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

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

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

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

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

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. 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 at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to 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.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. 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 Architect. 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 Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 033000

SECTION 116500 - ATHLETIC BALL NETTING SYSTEM

PART 1 - GENERAL

1.1 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.

D. Installer should have a minimum of five (5) ball safety netting system installations or similar experience in the previous three (3) years

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. 20’ Tall Athletic Straight Line Tension Ball Netting System

B. The ball netting and the chain link fence are aligned, field side face of the posts that shall be aligned.

C. The ball netting material shall terminate at the top of the fence line and secured to the top of the fence in that location.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. Cast-In-Place Concrete

B. Chain Link Fence

C. Synthetic Turf System

1.4 REFERENCES

A. ASTM - American Society for Testing and Materials

1.5 LAWS, ORDINANCES, PERMITS AND FEES

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.
2. Obtain all required certificates of inspection for this work and deliver same to the Owner's Representative 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.

1.6 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.

1.7 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' Athletic Tension Ball Netting System
2. Stamped and Sealed Drawings and Calculations by a Licensed Professional Engineer of Record in North Carolina

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' Athletic Tension Ball Netting System

PART 2 - PRODUCTS

2.1 20' HIGH ATHLETIC BALL NETTING TENSION SYSTEM - BASIS OF DESIGN

A. 20’ Athletic Ball Netting System shall be equivalent to TNPP36 Pre-Engineered 20' Straight Pole Ball Safety Netting System and Accessories as manufactured by Sportsfield Specialties, 41155 State Highway 10, Delhi, NY 13753, (888) 975- 3343.

1. Steel pole spaced per manufacturer design standards.
2. Post color to be powder coat as selected from the Manufacturer’s Standard Colors. Color to be black.
3. 1 ¾” mesh netting and cables to be black, #36 Nylon Knotted
    a. Provide cutouts in netting at gate locations as indicated on plans.
    b. Netting heights, lengths and cutouts shall be verified in field prior to ordering and shall terminate at the top of the fence line.
4. Ground Sleeve length per manufacturer specifications
5. Provide Quick-Clips for Net Attachments and Net Guide Rings.
6. Stamped and Sealed Drawings and Calculations by a Licensed Professional Engineer of Record in North Carolina for the system and footers to be provided by the bidding contractor.
7. A two year complete netting system warranty is required.
8. Approved equals will be considered during the bidding process.

PART 3 - EXECUTION

3.1 ATHLETIC BALL NETTING SYSTEMS

A. Provide and install plumb and true to grade in accordance with the Manufacturer’s recommendations and Approved Shop Drawings.

B. Refer to the Drawings and Details for specific requirements for placement of posts and alignment with the Chain Link Fence Posts. Posts not properly aligned will be rejected and required to be reset.

C. Netting materials shall extend to the top of the chain link fence and be secured to the top of the fence. Attach netting to top of fence line.

D. TNPP36 Professionally Pre-Engineered 20’ Straight Line Safety Netting System and Accessories shall be installed as recommended per manufacturer's written instructions and as indicated on the drawings.

E. The contractor is responsible for sizing all concrete anchoring foundations to be determined by based on local soil conditions and building codes. Stamped and Sealed Drawings and Calculations by a Licensed Professional Engineer of Record in North Carolina for the system and footers to be provided by the bidding contractor.

END OF SECTION 116500

SECTION 116833 – ATHLETIC FIELD EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide and install new outdoor athletic equipment as listed.

1.2 SUBMITTALS FOR REVIEW

A. Shop Drawings: Shop Drawings shall be prepared showing all pertinent information regarding materials, assembly, and installation. Submit drawings showing sizes and details of all equipment component parts.

B. Product Data: Submit manufacturer's technical product data for all equipment specified under work of this section.

1.3 QUALITY ASSURANCE

A. Manufacturers to have a minimum of 10 years' experience in the manufacture of the equipment and products specified.

PART 2 - PRODUCTS

2.1 OWNER PROVIDED EQUIPMENT TO BE ASSEMBLED AND INSTALLED BY THE CONTRACTOR

A. Contractor to provide labor for assembly and placement of the following owner provided items.

1. Four (4) sets of five row aluminum bleachers
2. Four (4) 15' long aluminum dugout benches
3. Two (2) Regulation size soccer goals
4. Four (4) U12 size soccer goals
5. One (1) Full size NCAA portable mound
6. Two (2) Bullpen Mounds
7. Eight (8) Trash Cans

3.1 INSTALLATION

A. Place and/or install all athletic equipment in conformance with manufacturer's specifications.

END OF SECTION 116833

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

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

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary construction and support facilities, and temporary erosion and sedimentation control procedures.
2. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
4. Division 23 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

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

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

1.4 QUALITY ASSURANCE

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

1.5 PROJECT CONDITIONS

A. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

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

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

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

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

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

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

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 sediment and erosion control Drawings.

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

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

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Engineer.

3.4 UTILITIES

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

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

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

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

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

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, 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. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches.

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

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

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within tree protection zones.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

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

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

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

3.8 DISPOSAL

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

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Earth Moving: The extent of earth moving is indicated on the drawings. The work, in general, includes the following:

1. Preparation of subgrade for dam embankment, riser structure, headwall, and spillway.
2. Controlling surface water and groundwater.
3. Excavation of cut-off trench for embankment.
4. Fill placement and compaction for dam embankment.
5. Installation of drains.
6. Rough and finish grading of slopes.
7. Furnishing Unit Prices for additional earthwork.

B. Related Sections include the following:

1. Division 01 Section Construction Progress Documentation for recording pre-excavation and earthwork progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
3. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
5. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for dam embankment.

C. Excavation Definition: “Excavation” consists of removal of all material encountered to required subgrade elevations indicated and subsequent disposal of all materials removed.

1.3 DEFINITIONS

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

B. Excavation: Removal of all material encountered to required subgrade elevations indicated and subsequent disposal of all materials removed.

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

D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Washed stone (No. 67)
2. Filtration geotextile

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

A. Inspections, Laboratory, and Field-Testing Services:

1. Geotechnical Engineer: The owner will engage a Geotechnical Engineer for soil inspections, laboratory testing, and field-testing services for quality control testing during earthwork operations and foundation construction.
2. Test classification and compaction of soils. Tests will be performed at the following locations and frequencies:

    a. Dam Embankment and Key: Perform one test per compacted lift, per 2,000 square feet or less of embankment area, per day, but in no case fewer than three tests.
    b. Perform Gradation, Atterberg Limits, and Triaxial Shear testing as required to verify the intent of the Subsurface Exploration Report in accordance with ASTM D-422 and D-4318 and D-4767.

3. Allow Geotechnical Engineer to inspect and test subgrade and each fill or backfill layer: Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
4. When subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Additional testing performed to determine compliance of corrected work with specified requirements shall be at Contractor's expense.

D. Preinstallation Conference:

1. Before commencing dam embankment earthwork or construction, meet with representatives of governing authorities, Owner, Architect/Engineer, Civil Engineer, Geotechnical Engineer, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

E. Codes and Standards: Perform excavation work in compliance with all applicable requirements of governing authorities having jurisdiction.

F. Depth of Bearing Strata: It is to be understood that site soil conditions are variable across the site. Headwall foundation design dimensions and bearing elevations shown are minimums. The design of the footings is based on the assumed strata bearing capacity at the elevation shown on the drawings and as indicated in the General Notes. If the indicated depth of footing excavation is reached without developing the required strata bearing capacity, the Geotechnical Engineer will immediately advise the contractor for additional excavation to reach the required bearing elevation for each individual footing. Revisions will be paid for in accordance with the Contract condition relative to changes in the Work.

1.6 PROJECT CONDITIONS

A. Site Information:

1. The Contractor, by careful examination, shall inform himself as to the nature and location of the Work; the conformation of the ground, the nature of subsurface conditions; the locations of the groundwater table; the character, quality, and quantity of the materials to be encountered; the character of the equipment and facilities needed preliminary to and during the execution of the work; and all other matters which can be in any way affect the Work.
2. The Contractor shall examine the site, available drawings, records of existing utilities and construction, record of test borings, and the subsurface exploration reports and the soil and rock samples to determine conditions under which the Work will be performed.
3. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be held responsible for interpretations or conclusions drawn by the Contractor. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

C. Existing Utilities:

1. Locate all existing underground utilizes in areas of work before proceeding. Provide adequate support and protection during earthwork operations of utilizes that are to remain in place. Demolish existing utilities as indicated and completely remove from the project site. Coordinate with utility companies, or governing entity, for proper shut-off of services for active lines.
2. If any active utility not indicated in the drawings is encountered, notify the Engineer and protect from damage until instructions for proper disposition of the utility are given by the Engineer. Perform the requested work in compliance with the rules and regulations of authority having jurisdiction.
3. Repair active utilities schedule to remain that are damaged by earthwork operations to the satisfaction of the utility owner.
4. If any inactive utility not indicated on the drawings is encountered, remove, plug, or cap as directed by the Engineer. Obtain any necessary data relative to proposed abandonment of existing utility service from authority having jurisdiction.
5. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by the Construction Manager and then only after acceptable temporary utility services have been provided. Provide minimum of 48-hour notice to Construction Manager, and receive written notice to proceed before interrupting any utility.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: ASTM D 2487 Soil Classification Groups SM, ML, SC, and CL, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Unsatisfactory Soils: Soil Classification Groups MH, CH, GW, GP, GM, GC, SW, SP, OL, OH, and PT according to ASTM D 2487, or a combination of these groups.

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

C. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below topsoil or alluvium.

D. Approved Fill Material: All soil materials used for the project shall be approved by the Geotechnical Engineer prior to hauling and placement. Soil materials used for fill or backfill shall be retested and reapproved each time the source or properties of the material changes. The Select Granular Fill should be compacted to no more than 95 percent of the soil's standard Proctor maximum dry unit weight (ASTM D698). Select Granular Fill should be free from ice and snow, roots, sod, rubbish, debris, or other deleterious or organic matter. It should consist of durable, hard, non-carbonaceous soil particles conforming to the following requirements:

Table 3 – Select Granular Fill (k-min = 1.4 in/hr)

U.S. Seive Size	% Passing No. 200 Sieve)
2-in.	100
½-in.	100
No. 4	85-100
No. 10	70-100
No. 20	0-100
No. 40	0-95
No. 60	0-75
No. 100	0-40
No. 200	0-12

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Remove all existing trash, rubbish, debris, trees, roots, stumps, underbrush, shrubs, plants, and other vegetation from within the mass embankment limits.

3.2 PREPARATION

A. Survey Work, Grades, and Elevations:

1. Survey Work: Lay out dam centerline and headwall foundations after clearing but before excavation. Record actual measurements centerline location, deviation from specified tolerances, and all other pertinent data as required.
2. Grades and Elevations: Finished grades indicated by spot elevations and normal contour line elevations denote finished top surface elevations. Report conflicts, errors and

inconsistencies in grades and elevations to the Engineer for resolution. Do not proceed with the work in questionable areas until conflicts are resolved by the Engineer.

3. Maintain all benchmarks and other reference points.
4. Set required lines and levels as required to accurately perform the excavation work.

B. Protection of Work:

1. Protect the surface of the embankment fill during construction by sealing off with a smooth drum roller prior to prolonged delay such as the end of the work week or before a forecasted storm. Scarify the smooth surface before placing the next lift.
2. Protect any existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
3. Protect and maintain erosion and sedimentation controls during earth moving operations.
4. Protect subgrades soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
5. Do not commence earth moving operations until temporary erosion and sedimentation control measures in place.
6. Do not commence earth moving operations until plant protection measures are in place.
7. The following practices are prohibited within protection zones:

    a. Storage of construction materials, debris, or excavated material.
    b. Parking vehicles or equipment.
    c. Erection of sheds or structures.
    d. Impoundment of water.
    e. Excavation or other digging unless otherwise indicated.
    f. Attachment of signs or wrapping materials around trees or plants unless otherwise indicated.

8. Do not direct vehicle or equipment exhaust towards protection zones.
9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

3.3 DEWATERING

A. Excavations should be kept dry at all times by means of cofferdams, trenches, sumps, pumps, and whatever equipment or arrangements are required.

B. Prevent surface water and subsurface or groundwater from flowing into excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation and/or subsurface seepage.

D. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Establish and maintain temporary drainage ditches and other diversions outside

excavation limits to convey rain water and water removed from excavation as temporary drainage ditches. Do not use excavated trenches as temporary drainage ditches.

3.4 EXCAVATION, GENERAL

A. Excavation shall be unclassified and shall comprise and include the satisfactory removal and disposal of all materials encountered regardless of the nature of the materials and shall be understood to potentially include rock, boulders, fill and debris.

B. All excavation shall extend to the depths of the form and size required for the installation of the work as indicated on the Drawings. When excavations have reached the required depths, the Geotechnical Engineer shall make an inspection of the conditions.

C. Materials that in the opinion of the Geotechnical Engineer are not suitable for fill, any surplus earth, and rock shall be removed from the site and legally disposed of off-site.

D. The bottom of excavations shall be leveled off and graded to receive new compacted fill, outlet pipes, intake structure, etc.

E. Excavations made below the elevations shown or specified, unless authorized, shall be filled and compacted as hereinafter specified, at no additional cost.

3.5 EXCAVATION FOR STRUCTURE FOUNDATIONS

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

B. Subgrades shall be approved by the Geotechnical Engineer before proceeding with fill placement or installation of any structure or piping.

C. The top 12 inches of subgrade resulting from excavation shall be free of unsuitable material (fill, organics, debris, etc.) as judged by the Geotechnical Engineer.

D. Cut areas shall be excavated and graded to subgrade elevation per the Contract Drawings. The subgrade should be proof rolled with 10-ton roller compactor (vibration mode off). Any soft or wet areas, areas exhibiting pumping or areas that are otherwise unsuitable soils, as deemed by the Geotechnical Engineer, shall be removed and replaced.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Trenches for underground piping, where necessary, shall be excavated to the required depth and bell holes shall be provided where necessary to insure uniform bearing. Trench excavation lines shall provide sufficient clearance for proper execution of underground work.

B. Trenches shall be by open cut from the surface. No tunneling will be allowed. Irregularities at bottom of trench, or where excavation is below required depth, shall be refilled to required grade with compacted soil.

C. Where trenches are in wet or soft ground that in the opinion of the Geotechnical Engineer is unsuitable for supporting the pipe, concrete cradles or approved equivalent, shall be installed as directed by the Engineer.

D. Where necessary and per OSHA standards, the sides of trenches and excavations shall be properly sloped or supported by adequate sheeting and bracing to insure proper construction and safety of the workers. The Contractor will be held responsible for the sufficiency of sheeting and bracing and for all damages to property or injury to persons resulting from improper quality, strength, placing, maintaining and removing of same.

E. Backfill trenches with suitable fill. Scarify sides of excavation to facilitate bonding of soil. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Geotechnical Engineer or other authorized Owner's representative. Use care in backfilling to avoid damage or displacement of pipe system.

F. Immediately after piping has been installed, tested, inspected, and accepted, piping shall be filled around with special care to solidly fill voids without causing injury to piping. Up to 2 feet above, 4-inch layers shall be hand filled. For remainder of trench, 12-inch layers shall be filled in. Each layer shall be tamped before placing next layer. No stones larger than 2 inches in diameter shall be allowed in fill up to 2 feet above pipe and no stones larger than 4 inches in diameter shall be allowed in fill above. Backfill shall be in such a manner so as to prevent future settlement.

G. Existing utility lines to be retained that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at own expense.

H. As backfilling proceeds, all sheeting and shoring shall be removed in such a manner as to prevent the sides of the excavation from caving in or cracking. No backfilling of utility lines shall be done until any testing and inspection of the system or portion of the system has been completed and accepted.

I. Unless otherwise shown or specified, make trenches for piping and utilities not less than 16 inches no more than 24 inches wider than the outside width of the piping or utilities. Accurately grade bottoms of trenches with bell holes scooped out to provide uniform bearing and support of pipe and utilities on undisturbed soil throughout its entire length, except where other means of supporting pipe are indicated.

3.7 PLACING AND BACKFILL

A. General: Place fill or backfill on subgrades free of mud, frost, snow, or ice. It is to be understood that some selective reconnaissance and excavation will be required to obtain Embankment Fill Material.

B. Place Embankment Fill material in compacted, uniform, continuous layers. The more fine grained soils shall be placed in the central portion of the dam and in the cut-off trench areas.

C. Ground surface preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to fill placement. Plow, strip, or break-up slope surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

D. Grading:

1. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
2. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within plus or minus 1 inch.
3. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

3.8 COMPACTION

A. General: Control all soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below. Place backfill and fill materials in layers not more than 8.0 inches in loose depth for material compacted by heavy compaction equipment, and not more than 3.0 inches in loose depth for material compacted by hand-operated compaction equipment.

B. Density Requirements: Compact fill to not less than the following percentages of maximum density for soils in accordance with [**ASTM D 698**]:

1. Embankment: Compact each lift of fill material to at least 95% of the material's maximum dry density while maintaining the soil moisture content within 2% below to 3% above optimum moisture content.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, apply water as needed.
2. Remove and replace, or scarify and air dry, soil material that is too wet to compact to specified unit weight.
3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing or harrowing.

3.9 DRAINS

A. Construct subsurface drainage during grading operations at locations and dimensions shown on the approved drawings.

3.10 GRADING

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

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

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. The Geotechnical Engineer shall review all laboratory test results and submit reports specified in this Section. Geotechnical Engineer will also observe, in the field, all earthwork related operations.

C. The Geotechnical Engineer will interpret the tests, state in each report whether or not the test specimens comply with all requirements of the Contract Documents and note any deviations therefrom.

D. The Geotechnical Engineer will identify when and where samples are to be obtained. Contractor shall collect samples and forward them to the Testing Laboratory for testing. As necessary, the Geotechnical Engineer will submit the following laboratory test reports on each type of borrow and fill material:

1. Gradation Analysis – ASTM D 422.
2. Atterberg Limits – ASTM D 4318.
3. Standard Moisture-Density Relationship – ASTM D 698.

E. The Geotechnical Engineer will determine the conformance of material to be used for fills.

F. Field Testing of Fill Areas: Prepared fill lifts will be tested and approved by the Geotechnical Engineer before construction of any further work thereon. Inspection and test of subgrades and fill layers will be taken as follows:

1. For each compacted fill layer, make a minimum of 2 field density tests for every lift. Perform field density tests in accordance with ASTM D 1556 or D 6938. Each lift shall meet the compaction requirement of Part 3.8 of this Section.

G. Footing Subgrades: Geotechnical Engineer shall inspect bearing surfaces and monitor proof rolling operations at foundation subgrade locations.

H. Contractor shall cooperate with Geotechnical Engineer in the performance of the required tests and inspections.

I. 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 to depth required; recompact and retest until specified compaction is obtained. Additional compaction and testing shall be at the expense of the Contractor.

3.12 MAINTENANCE

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

B. Repair and reestablish grades in eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify surface, reshape, and compact to required density prior to further construction.

C. Where settling is measurable or observable at excavated areas, add backfill material and compact. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Contractor. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 312319 - 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 33 Section "Subdrainage" for permanent dam embankment drainage.

1.3 PERFORMANCE REQUIREMENTS

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

1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

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

a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
b. Geotechnical report.
c. Proposed site clearing and excavations.

1.5 PROJECT CONDITIONS

A. 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 bid documents

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent 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 Engineer if changes in elevations occur or if any 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.

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 01 Section "Temporary Facilities and Controls Division 31 Section Site Clearing during dewatering operations.

3.2 INSTALLATION

A. Contractor shall furnish, install, operate, and maintain any pumping equipment, etc. needed for removal of water from various parts of the stormwater facility.

B. Contractor shall coordinate with Geotechnical Engineer as needed.

3.3 FIELD QUALITY CONTROL

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

END OF SECTION 312319

SECTION 312500 – EROSION CONTROL

PART 1 - GENERAL

1.1 INTENT

A. The main concern associated with erosion on a construction site is the movement of soil off the site and its impact on water quality. It is the Owner's intent that the Contractor install and maintain sufficient erosion control practices to retain sediment within the boundaries of the site in addition to complying with regulatory authorities having jurisdiction and local erosion and sedimentation control laws and ordinances. All erosion control methods and devices used shall conform to the latest requirements imposed by federal, state, and local authorities. The Contractor shall be responsible for repair of any damage caused and shall be financially responsible for any penalties imposed.

B. If an erosion control drawing has been included in the drawings prepared by the landscape architect/engineer, it shall be the Contractor's responsibility to review the drawing prior to implementation. If an erosion control drawing is not included in the project documents, the Contractor shall submit, for approval, a proposed sequence of operations and a compatible method of preventing erosion.

1.2 SUMMARY

A. Work under this section shall include but not be limited to, installation and maintenance of both temporary and permanent soil erosion control measures, slope protection and stabilization measures, protection of all surface water and property both on and off site. This work shall include all labor, materials, and equipment necessary to meet all applicable requirements and as specified in the contract documents.

1.3 REFERENCE STANDARDS

A. Soil erosion and sediment control measures shall be implemented in accordance with the requirements and procedures outlined in this specification, contract drawings and documents, the state standards or guidelines for soil erosion and sediment control, and all regulatory authorities having jurisdiction. Where conflict between requirements exist, the more restrictive rules shall govern.

B. The Contractor shall provide all temporary control measures shown on the drawings, or as directed by the Owner, Owner's representative, or soil conservation district for the duration of the contract. Erosion control drawings are intended to be a guide to address the stages of work shown. Additional erosion control measures not specified on the drawings may be necessary and shall be implemented to address intermediary stages of work and any conditions that may develop during construction at no cost to the Owner.

C. Temporary control provisions shall be coordinated with permanent erosion control features to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period.

D. Soil erosion and sediment control measures shall at all times be satisfactory to the Owner's Representative. Owner's Representative will inform the Contractor of unsatisfactory construction procedures and operations if observed. If the unsatisfactory construction procedures and operations are not responded to and corrected within 48 hours, the Owner's Representative may suspend the performance of any or all other construction until the unsatisfactory condition has been corrected. Such suspension shall not be the basis of any claim by the Contractor for additional compensation nor for an extension of time to complete the work. Any complaints, fines, etc. relating to ineffective erosion control, shall be the sole responsibility of the Contractor.

E. The Contractor shall inspect all soil erosion and sediment control measures at least at the beginning and end of each day to ascertain that all devices are functioning properly during construction. Maintenance of all soil erosion and sediment control measures on the project site shall be the responsibility of the Contractor until the project is 100% complete, and until the permanent soil erosion controls are established and in proper working condition.

F. The Contractor shall protect adjacent properties and watercourses from soil erosion and sediment damage throughout construction.

1.4 SEQUENCE OF CONSTRUCTION

A. The approved construction sequence, as permitted/approved shall be adhered to during the execution of work under this section. All soil erosion and sediment control measures shall be installed in accordance with the phasing sequence shown on the contract documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Contractor shall provide all materials necessary to perform the work.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall comply with and implement the Erosion and Sedimentation Control Plans provided in the contract documents.

B. Review the soil erosion and sediment control drawings as they apply to current site conditions. Any deviation from the drawings must be submitted for approval to the owner/landscape architect in writing at least 72 hours prior to commencing that work.

C. All soil sediment and erosion control devices shall be in place prior to any earthwork construction, in their proper sequence, and maintained until permanent protection is established.

D. The limit of the area of any earthwork operations in progress shall be commensurate with the Contractor's capability and progress in keeping the finished grading, mulching, seeding and other such permanent control measures current and in accordance with the accepted schedule for construction phasing. Should seasonal limitations make such coordination unrealistic, as determined by the Owner's Representative, temporary erosion control measures shall be provided immediately by the Contractor at no expense to the Owner.

E. Temporary erosion control measures shall be used to correct conditions which develop during construction that are needed prior to installation of permanent control features, or that are temporarily needed to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

F. The Contractor shall incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls.

G. A temporary construction entrance pad shall be installed and maintained at any point where construction vehicles enter a public right-or-way, street or parking area. The pad shall be used to eliminate mud from the construction area onto public right-of-way. The pad shall be constructed as shown on the drawings. Any mud or debris tracked on streets shall be cleaned up immediately.

H. Any disturbed or stockpiled areas that will be left exposed more than 14 days, and not subject to construction traffic, shall immediately receive a temporary seeding. Mulch/straw shall be used if the season prevents the establishment of a temporary cover. Disturbed areas shall be limed and fertilized prior to temporary seeding.

I. Permanent vegetation shall be established as specified on all exposed areas within 14 days after final grading, unless otherwise directed by the Owner and permitted by appropriate regulations. Mulch as necessary for seed protection and establishment. Lime and fertilize seedbed prior to permanent seeding.

J. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical. Slopes that erode easily shall be temporarily seeded and mulched.

K. All storm drainage outlets must be stabilized, as specified, before the discharge points become operational. Equip all inlets with inlet protection immediately upon construction.

L. Discharge from de-watering operations for the excavated areas shall not be directed to surface waters without first properly removing the suspended sediment through filtration and/or settlement. The Contractor shall obtain any required permits associated with dewatering activities.

M. The quantity of silt fence to be installed will be affected by the actual conditions that occur during the construction of the project. Silt fence shall be installed at locations shown on the drawings and any additional locations necessary for proper erosion control. The Contractor shall maintain the silt fence until the project is accepted and shall remove and dispose of the silt fence and silt accumulations.

N. Soil erosion and sediment control shall include but not be limited to the approved measures. The Contractor shall be responsible for providing all additional measures that may be necessary to accomplish the intent of the drawings.

O. Comply with all other requirements of authorities having jurisdiction.

END OF SECTION 312500

SECTION 321373 – PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

1.2 SUBMITTALS

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

B. Samples: For each type and color of joint sealant required.

C. Product certification and test reports.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer.

1.3 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to AASHTO M153 for Type I,II, or III; or be a bituminous type that meets AASHTO M213 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 32 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 32 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

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

B. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations and coordination with architect.

2.3 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Available Products:
   a. Crafco Inc.; RoadSaver Silicone.
   b. Dow Corning Corporation; 888.
   c. NCDOT approved equal

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Available Products:

   a. Crafco Inc.; RoadSaver Silicone SL.
   b. Dow Corning Corporation; 890-SL.
   c. NCDOT approved equal.

2.4 HOT-APPLIED JOINT SEALANTS

A. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 6690.

1. Available Products:

   a. Koch Materials Company; Product No. 9005.
   b. Koch Materials Company; Product No. 9030.
   c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
   d. NCDOT approved equal.

2.5 JOINT-SEALANT BACKER MATERIALS

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

B. Type L – A closed-cell expanded polyethylene foam backer rod. Use in roadway and bridge joints with Type NS silicone only.

C. Type M – A closed-cell polyolefin foam backer rod which has closed-cell skin over an open-cell core. Use in roadway and bridge joints with both silicon sealant types

D. Backer Rods for Cold-Applied Sealants: ASTM D 1622, 2lbs/cf minimum; ASTM D 1623 25 psi minimum; ASTM C 509 0.5% by volume maximum.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

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

D. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

E. Install sealants at the same time backings are installed to completely fill recesses provided for each joint configuration and to produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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

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

END OF SECTION 321373

SECTION 321823.29 – SYNTHETIC TURF SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This specification is for synthetic turf for Academy Complex Renovations. Scope of work to include all labor, material, equipment, transportation and services to install complete new vertical draining in-filled synthetic turf surfacing system.

B. It is the intent that the bidding general contractor employ one of the sports field manufacturers (see B.2) and a qualified sport field contractor to coordinate the installation of the synthetic turf. It is the general contractor's contract responsibility to furnish all labor, materials, testing, tools and equipment necessary to install, in place, all synthetic turf as indicated on the drawings and specified herein. It is acceptable for the turf manufacturer to act as the bidding general contractor as long as they are licensed for general contracting work in North Carolina under the correct classifications.

1. Turf Systems: Hybrid Slit Film/Monofilament Turf System – 2.0 inch pile height with SBR Rubber and Sand Infill.
2. Approved Sport Turf Manufacturers**:**
    a. Shaw Sports Turf
    b. AstroTurf
    c. SprinTurf
    d. Greenfields
    e. Additional turf vendors will not be considered.
3. The installation of all new materials shall be performed in strict accordance with the manufacturer's written instructions and in accordance with approved shop drawings.
4. Additional requirements can be found within this specification.

C. Pricing Package

1. Base Bid - Provide a 2.0" synthetic turf field system as defined in specifications installed on an aggregate base with associated drainage.

D. Provide equipment and materials and do work necessary to construct the synthetic field system, as indicated on the Drawings and as specified. Work shall include but shall not be limited to:

1. Subgrade and Base Construction
    a. Subgrade construction
    b. Gravel base construction
    c. Excavation, trenching, grading, backfilling, compaction to achieve subgrade as Needed

d. Install collector drains
e. Install panel drains
f. Laser grading
g. Disposal of spoil materials off site.
h. Grade elevation verification of finish stone grade and acceptance prior to gravel install.

2. Curb, Fencing and Netting

a. Install curbing with integrated fencing and netting
b. Provide expansion joints
c. Disposal of trench spoils
d. Install post, fabric and netting

3. Synthetic Turf Field

a. Nailer board
b. Synthetic Turf
c. SBR and Sand Infill material (Brock Fill Alternate)
d. Inlays and lines
e. Related finish work

4. As-built Drawings

a. Complete set of construction as-builts in CAD

1.2 RELATED WORK

A. Review all Construction Documents for the following work-related items to be included in the project

1. 322200 Resilient Underlayment
2. 321313 Concrete Paving
3. 321823.40 Wood Based Organic Infill
4. 323113 Vinyl Chain Link Fencing

1.3 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. Drawings and the general provisions of the Contract, including General and Supplementary Conditions and other Division I Specification Sections, apply to this section.
2. Installation shall comply with rules and/or regulations for field play set forth by the Nation Federation of High School Sports (NFHS). Contractor to provide shop drawing striping plans for all fields prior to construction to ensure compliance.
3. American Society for Testing and Materials (ASTM): Latest standard test methods for the products used for the synthetic turf product system, RCRA testing approved by the

EPA. And, European Committee for Standardization of International Playing Surfaces EN 1177 for Head Injury Criteria.

a. Testing for Wheelchair Accessibility is required – (F1951-0)
b. Standard Test Methods for Laboratory Compaction Characteristics of Testing for Water Permeability of Synthetic Turf Systems and Permeable Bases (F1551) is required.
c. Additional Testing Required as per Section 3.13 for the Synthetic Turf System.

1.4 SUBMITTALS

A. Provide one (1) 12" x 12" boxed sample of proposed synthetic turf carpet and infill, and physical color samples of all color inlays requested.

B. Signed public welfare and safety affidavit of heavy metal and containment free synthetic turf system.

C. Digital .pdf copies of all third-party ASTM product data and testing documents stated in the specifications section demonstrating that proposed system meets or exceeds all specified requirements Submit to Owner for approval. All testing shall be paid for by the Contractor.

D. List of all company litigation in the last 10 years pertaining to synthetic turf construction. Includes litigation history for all associated subcontractors.

E. Affidavit signed by an authorized representative of the Synthetic Turf Manufacturer attesting that the Sports Field Contractor is accepted and certified by the STM.

F. Copy of standard eight (8) year warranty against workmanship and materials on the proposed synthetic turf

G. Submit a list of all material providers, including relevant contact information.

H. Provide both a delivery and installation schedule.

I. Provide a list and contact information of all subcontractors.

J. The turf manufacturer shall submit a signed statement for the safety of their product regarding lead, heavy metals and other chemicals used in manufacturing of the product.

K. Submit all compaction test results of the subgrade and gravel layer to conform with drawings and specification requirements.

L. Prior to Final Acceptance, the Contractor shall submit one (1) digital .pdf copy of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.

M. Provide testing results that show the provided turf system and specified infill meets Wheelchair Accessibility – (F1951-0) requirements.

N. Base stone gradation testing, base and finish courses.

O. All required submittals listed within this specification. Please refer to each section for additional requirements and submittals.

P. Qualification of the drainage base sub-contractor. See requirements in Section 1.6.

1.5 SHOP DRAWINGS

A. Shop drawings shall be prepared and contain all pertinent information regarding installation. These drawings shall be submitted to the Owner for approval prior to the manufacturing and shipment of materials.

B. Submit drawings for.

1. Seaming plan
2. Logos, layout and field striping details and dimensions
3. Manufacture installation details
4. Any proposed details that may deviate from plan documents

1.6 QUALITY ASSURANCE AND WARRANTY

A. Manufacturer / Installer's Experience.

1. The Sports Field Base Contractor/Installer must have installed and/or provided a minimum of five (5) full size synthetic turf football fields in the last three (3) years. The Contractor shall employ only qualified, experienced supervisors and technicians skilled in the installation of this system.

B. Hold Harmless Clause

1. The turf manufacture and sport field contractor shall indemnify the School District and design team consultants from any potential patent and/or trademark infringements, litigation and or trade secret issues identified during the bid and construction process.

C. Singular Responsibility for Performance and Installation of the Drainage System and Synthetic Turf.

1. The engineered drainage base shall be furnished or installed by the synthetic turf manufacturer or installed by a contractor or subcontractor under direct contract with the synthetic turf manufacturer and approved by manufacturer in writing and submitted to the designer for review.

2. Contractors or subcontractors installing the drainage base shall demonstrate a minimum of five (5) years of experience in constructing drainage bases for synthetic turf athletic fields of similar size and scope. A reference letter must be submitted by the synthetic turf manufacturer for any drainage base sub-contractors.

3. Turf system warranty shall be contingent upon compliance with the above requirements.

D. Warranty

1. The Contractor shall submit its Manufacturer's Warranty that guarantees the usability and playability of the synthetic turf system for its intended uses for a minimum eight (8) year period commencing with the date of Final Acceptance. The warranty coverage shall not be prorated nor limited to the amount of the usage. The warranty submitted must have the following characteristics:

   a. Must provide full coverage for eight (8) years from the date of Final Acceptance.
   b. Must warrant materials and workmanship.
   c. Must warrant that the materials installed meet or exceed the product specifications.
   d. Must have a provision to repair or replace such portions of the installed materials that are no longer serviceable to maintain a serviceable and playable surface.
   e. Must be a warranty from a single source covering workmanship and all self-manufactured or procured materials.
   f. Guarantee the availability of replacement material for the synthetic turf system installed for the full warranty period.
   g. The Sports Field Contractor may be required, upon the request of the Owner, to provide a list of three (3) clients for which they have completed after-the-sale warranty work.
   h. Any issues with type of shoe requirements for multi-sport play must be stated in the Warranty.
   i. The 8-year warranty must also be supported by a 3rd party insured warranty from an A-rated domestic insurance carrier. The value of the policy shall be no less than $5,000,000 per occurrence, no deductibles allowed, with a total annual policy aggregate of $10,000,000 renewed per each year of use. Only true 3rd party policies will be accepted. Companies submitting policies that are letters of credit or not truly a 3rd party insurance policy will not be accepted. Submit three (3) copies of the actual insurance policy.
   j. The 8-year warranty shall cover the following designated uses and associated wear characteristics for each sport use below
      1) NFHS Soccer
      2) NFHS Lacrosse
      3) Sport Camps
      4) General Recreation
      5) Special Events
      6) Pneumatic tire vehicle access
      7) Maintenance in accordance with manufacture recommendations

E. Maintenance

1. The Contractor shall supply the Owner with a digital pdf of a written maintenance manual for proper care of the finished product. The maintenance manual shall specify any use limitations for the field (e.g. heavy vehicle traffic, etc.)

F. System Performance Characteristics

1. G-Max (shock attenuation) must test below 110 at installation.
2. The various Gmax Values should not vary each year by more than 10% above or below the average at time of installation for any individual drop.
3. Lifecycle Gmax Values: The maximum Gmax Value throughout the warranted lifecycle of the synthetic turf playing surface is not to exceed 135G.
4. The depth of the infill material shall be measured at each test location
5. Critical Fall Height (HIC) greater than 1.3M
6. All testing shall be performed by a certified third-party independent lab and paid for by the Contractor.
7. After the Contractor installs the system, he must guarantee that the field will meet the following performance criteria

    a. The system shall allow a minimum percolation rate of 20 inches per hour. ASTM F2898 Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-Confined Area Flood Test Method.
    b. Relative Abrasiveness (to ASTM F 1015). The system has an Abrasiveness Index of 20.2
    c. Shock Absorbency (to ASTM F355, ASTM F 1936) Less than 135 G-Max for 8- year warranty.
    d. Flammability (to ASTM D 2859).

1.7 COMPLETION AND ACCEPTANCE

A. Punch list shall be scheduled at least 10 days before the Substantial Completion Date.

B. Owner shall be notified of the Punch List date 10 days before planned occurrence in writing.

C. All items to be installed and in working order prior to Punch List request.

D. After Punch List items are corrected, the contractor shall notify the owner for “Substantial Completion” 10 days prior.

PART 2 - PRODUCTS

2.1 SYNTHETIC TURF PRODUCT

A. The turf field shall be a rubber and sand infilled 2.0” fiber slit film/monofilament synthetic grass system. Provide all ASTM/EIN/EPA test as applicable with the turf submittal.

B. Turf product to be a rubber and sand infilled 2.0” fiber slit film/monofilament synthetic grass system on a resilient underlayment system. Below are the minimum standards required.

Base Bid - Turf Requirements:	**Description**
1. Turf Type	Dual Fiber (Slit Tape/Mono Hybrid)
2. Base Turf Color	Field Green

3.	Pile Height	2.0"
4.	Exposed Fiber Height	Per Manufacturer Specifications
5.	Pile Yarn	UV Resistant Polyethylene
6.	Slit Tape Fiber	XP Blade + or Equal
7.	Mono Fiber Type	Ridged
8.	Face/Pile Weight	48 oz per SY Min.
9.	Primary Backing	6.7 oz/SY Min.
10.	Primary Backing UV Stabilizer	1000 hours of QUV A testing
11.	Secondary Backing	20 oz/SY Min.
12.	Total Carpet Weight	74 oz/SY Min.
13.	Machine Gauge	Per Manufacturer Specifications
14.	Tuft Bind	Min. 8lbs without infill, 10lbs with infill
15.	Grab Strength	> 200 lbs. avg.
16.	Grab Tear Width	> 200 lbs. avg.
17.	Pill Burn Test	Pass
18.	Shock Pad Alternate	Brock SP17 XL – Basis of Design
19.	Infill Base Bid (No Pad)	SBR 70% Sand 30%
20.	Infill (Pad Provided)	SBR 50% Sand 50%
21.	Infill Alternate	Organic Wood Infill – 4lb Sand 1lb Organic
22.	Infill Rubber Granule Comp	SBR Rubber
23.	Infill Rubber Spec. Gravity	1.1 min to 1.2 max
24.	Infill Rubber Ash Content	Between 5% and 15%
25.	Infill Rubber Sieve Analysis	10 / 20 Mesh (2.0mm - 0.85mm)
26.	Infill Sand Granule Shape	Semi-rounded to rounded angularity
27.	Infill Sand Sieve Analysis	20 / 40 Mesh (0.85mm - 0.425 mm)
28.	Infill per SF	Min. 5.0 lbs.
29.	Infill Depth	+/- 1.5”
30.	Fabric Width	15'-0
31.	Yard Denier Slit Film	5,000 Min.
32.	Yard Denier Mono	10,000 Min.
33.	Breaking Strength	18 lbs./sf
34.	Yarn Melting Point	246 degrees

C. The Secondary Backing of high-grade polyurethane shall be applied to the Primary Backing. The tuft bind shall be a minimum average of 8 lbs. without infill and 10 lbs. with infill.

D. Turf products with permeable backing do not require perforations.

E. All perforations shall be unobstructed.

F. Turf products with a coated or non-drain thru backing must include perforations in the backing.

G. All turf carpet and infill material shall be provided by a single source and documented accordingly.

H. All inlaid lines will be tufted in the factory to the extent practical. All widths of lines per NFHS rules.

I. All seams shall be flat, tight, and permanent with no separation or fraying.

J. Carpet rolls shall be 15-foot widths.

K. The finished surface shall function as a grass field with similar natural playing grass field characteristics.

L. The use of all conventional athletic shoes shall be allowed and identified in the warranty specifications.

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

N. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use.

O. Sew or glue seam turf as recommended by the synthetic turf manufacturer.

2.2 INFILL BASE BID (SAND AND SBR RUBBER)

A. Infill should be a combination of 70% SBR and 30% Sand without a shock pad.

B. Infill should be a combination of 50% SBR and 50% Sand if a shock pad is included in the project.

C. The crumb rubber shall have a specific gravity range from 1.1 minimum to 1.2 maximum as determined by ASTM D 297 (including any modifications made by ASTM in the future).

D. The crumb rubber shall have an ash content of between 5 and 15% as determined by ASTM D 297 (including any modifications made by ASTM in the future).

E. The crumb rubber shall not contain more than .01% (of the total weight of crumb rubber) liberated fiber (no more than 0.6 lbs per ton) tested per ASTM D 5603.

F. The infill materials shall conform to the synthetic turf vendor’s standard specifications and warranty.

G. All sand infill to have clean rounded particles and meet manufacturer’s requirements.

2.3 ORGANINC WOOD INFILL - ALTERNATE

A. Infill should be a combination of four (4) pounds of Sand and one (1) pound of all wood organic infill per Square Foot

B. The infill materials shall conform to the synthetic turf vendor's standard specifications and warranty.

C. All sand infill to have clean rounded particles and meet manufacturer's requirements.

D. See Organic Infill Specification 321823.40

2.4 RESILIENT UNDERLAYMENT PAD- ALTERNATE

A. Brock SP17 XL - Basis of Design

B. See specification 322200 Resilient Underlayment Pad

C. Install per manufactures recommendations.

D. Proposed alternate resilient underlayment pads, must show a United States FIFA Quality or higher certification for a system that includes the proposed pad and organic wood infill within the past two years.

2.5 GEOTEXTILE

A. Geotextile Filter Fabric for the Subgrade and Collector Drainage: Non-woven polypropylene geotextile fabric shall be chemically and biologically inert. The subgrade shall be covered in its entirety with a geotextile fabric meeting the following specifications. The geotextile shall be woven from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters and pass a minimum of 135 gpm. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages

B. Geotextile for the subgrade shall have minimums:

1. Mass/Weight of 4.5oz oz/yd2
2. Flow rate 135 gal/min/ft2
3. Permivity 1.8 cm/sec
4. Tensile Strength 120 lbs
5. Elongation 50%
6. Trapezoid Tear Strength 50lbs
7. Apparent Opening Size 70 US Sieve
8. UV Resistance 70/500 % hours

2.6 DRAINAGE PIPE

A. Perforated pipe shall be double wall high-density polyethylene pipe (HDPE) and shall conform to all associated AASHTO requirements.

B. HDPE Perforated pipe shall Class have 2 slotted perforations in accordance with associated AASHTO requirements.

C. Solid wall pipe shall be high-density polyethylene pipe (HDPE) and shall conform to associated AASHTO requirements.

D. Inline structures only are to be used for collector drains. Risers with fittings are not allowed.

E. Collector basins/cleanouts to be Nyloplast or approved equal with solid grates

F. Panel Drains and Fittings shall be 1”x12” wide composite pipe.
1. Advanedge
2. MultiFlow
3. J-Drain
4. Approved Alternate

2.7 STONE BASE COURSE

A. Stone Base Courses: The following gradation of stone is a typical and recommended specification. The Synthetic Turf Base Contractor is required to focus on achieving the planarity, porosity and compaction requirements to provide a sound crushed stone base for synthetic turf installation. The free-draining base aggregate base layer shall consist of a consistent depth of open graded material. Base drainage aggregate used must achieve a 95% minimum overall compaction rate.

B. Material shall conform to the AASHTO and NCDOT #57 and #78 classifications. Local or regional stone specifications that meet, sieve, compaction and porosity requirements are permitted, but must be approved by the designer prior to construction.

C. The stone base shall conform to the turf vendor’s standard specifications subject to the Designer’s approval and meet the following requirements using ASTM Method C136: The open graded aggregate material shall conform to the following criteria:

#78 Finish Stone	
Sieve Size	% Passing by Weight
3/4”	100
1/2”	98-100
No. 4	20-45
No. 8	0-15

#57 Free Draining Base Stone	
Sieve Size	% Passing by Weight
1-1/2”	100
3/4”	95-100
1/2”	25-60
No. 4	0-10
No. 8	0-5

D. All stone shall be angular. Rounded or river stone is not acceptable.

E. In no instance, shall multiple quarry sources be used within a single playing field area. Bridging Characteristics:

1. a) $\frac{3< \text{ D50 base stone } <6}{\text{D50 top stone}}$ b) $\frac{\text{D85 top stone } <2}{\text{D15 base stone}}$

F. All stone shall be angular. Rounded will not acceptable.

G. The stone material shall be AASHTO#57 and #78. Material must be clean. NCDOT approved gradations will be accepted as long as they meet the AASHTO baseline specification.

H. In no instance, shall multiple quarry sources be used within a single playing field area.

I. All stone shall be angular. Rounded or river stone is not acceptable.

J. Stone shall not come from multiple source locations.

K. Permeability for base stone shall be greater than 50”/hr.

L. Permeability for combined stone sections shall be greater than 30”/hr. 3rd Party Testing Required.

2.8 PRESSURE TREATER NAILER

A. A pressure treated 2” x 4”, or equivalent nailing strip shall be used and installed around the entire perimeter of the field.

2.9 FIELD CONCRETE CURB

A. All new concrete field curb dimensions shall be per plan

B. Anchor attachments shall be approved by the manufacture for concrete setting.

C. Concrete curbing shall have appropriate control and construction joints installed per specifications

D. Concrete shall 4000 PSI minimum.

E. Field curb shall be designed to contain all infill within the curb line.

PART 3 - EXECUTION

3.1 GENERAL

A. The installation shall be performed in full compliance with approved shop drawings.

B. Only factory-trained technicians skilled in the installation of synthetic turf systems shall undertake the placement of the system.

C. The surface to receive the synthetic turf shall be inspected and certified by the manufacturer as ready for installation of the synthetic turf system and must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

D. The turf system shall be fibrillated only after the infill material is installed with a machine specifically designed to do so. All contactors shall be familiar and understand all drawings and specifications for the work prior to beginning construction.

E. All work shall be protected from inclement weather conditions.

F. Verification of Conditions: Examine areas and conditions under which all work of this Section is being performed. Do not proceed with any work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

G. Site shall be secure to limit unauthorized personnel access and measures taken to protect all workers.

H. Unanticipated Conditions: Notify the designer and owner immediately upon finding evidence of previous structures, filled materials that penetrate below designated excavation levels, or other conditions which are not shown, or which cannot be reasonably assumed from existing surveys and geotechnical reports. Secure the Engineer’s instruction before proceeding with further work in such areas.

I. The Project Superintendent shall thoroughly inspect all materials delivered to the site both for quality and quantity to assure that the entire installation shall have sufficient material to maintain proper mixing ratios.

3.2 INSTALLATION LIMITATIONS

A. Site conditions exist, or are pending, that will be unsuitable for the installation of the turf system.

3.3 SUBGRADE AND EARTHMOVING

A. Establish required lines, levels, contours and datum. Contractor responsible for work shall coordinate and ensure that the final grades of subgrade, stone base and playing surface meet the established design requirements.

B. Maintain all benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.

C. Locate all utilities before grading. Coordinate with the Owner.

D. If groundwater levels are sufficiently high, provide pumps in sumps as required maintaining groundwater at a minimum depth of two feet below excavation bottom at all times. Maintain dry conditions until completion and acceptance of the base, prior to synthetic turf placement.

E. Monitor groundwater during construction.

F. Prevent surface water from infiltrating and damaging the subgrade and stone base.

G. There shall be no ponding on site at any time.

H. For all excavation requirements procedures refer to geotechnical report and Earthmoving specification.

I. For all structural fill requirements and procedures refer to geotechnical report and Earthmoving specification.

3.4 SUBGRADE SLOPES AND FINAL GRADES

A. Final subgrade grades shall conform to the proposed grades. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.04 feet in 25 feet in any direction. Laser grading is required.

B. A North Carolina signed and sealed survey of the finished subgrade base is required for review and approval prior to turf installation.

C. If the subgrade base does not meet the specification requirements, rework and resurvey will be required.

3.5 SUBSURFACE COLLECTOR PIPE DRAINAGE

A. All subsurface laterals shall be designed by contractor’s engineer, and installed per manufacture recommendations

B. Install geotextile fabric per plan documents.

C. Only perform trenching, drainage pipe installation and backfilling operations that can be completed in one day. Exposed trenches that collapse due to rain or other occurrences shall be

widened and filled as specified or refilled with subgrade materials, compacted, and retrenched.

D. Lay perforated collector pipe in accordance with pipe manufacturer's recommendations.

E. Contractor to back fill trenches with clean washed drainage stone that matches the existing turf stone composition.

F. Collector drains shall be installed per the slopes designed by the contractors' engineer. Pipes shall be installed, connected and fully mudded into any and all catch basins, or drop boxes designed.

G. All panel drains shall be attached to form a continuous drain. Refer to manufacture specifications regarding connection procedures and requirements for panel drain field connections.

H. All pipes shall be installed per slopes and grades shown on contractors approved plans, shop drawings, and permitted drawings.

I. Remove all spoils associated with trenching offsite at contractor's expense.

3.6 TURF NAILER

A. A pressure treated wood 2" x 4", or equivalent nailing strip shall be used.

B. Specifications and shop drawings for nailer and anchors shall by submitted Synthetic Turf Manufacturer (STM) for review and approval prior to contractor installation.

C. After installation of the concrete curbing the contractor shall install the nailer, prior to final placement of the top stone rock for synthetic turf base.

D. Nailer shall be installed using concrete anchors as specified by the Synthetic Turf Manufacturer (STM)

E. Nailer shall be anchored at both end of board, and every 15" along entire length of product installed.

F. Nailer shall be installed to an approved dimension below grade, as specified by the synthetic turf carpet supplier. Contractor shall verify finish grade of nailer with turf contractor.

G. Any anchors that do not fully drive into concrete shall be removed and new anchor installed adjacent on either side of the previous anchor that failed to install fully

3.7 CONCRETE CURBING

A. Clean existing concrete surfaces thoroughly before placing abutting fresh concrete.

B. Concrete curbing for synthetic turf shall be per plan details. Finish shall be medium broom.

C. Concrete curbing shall have appropriate control, expansion and construction joints installed per details.

D. All curbing adjacent to walls and buildings shall have expansion joints.

E. Every fence post embedded in the curb shall either have a control joint or expansion joint where required.

3.8 GEOTEXTILE FABRIC

A. The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic.

B. Adjacent geotextile rolls shall be overlapped. Overlaps shall be in the direction as shown on the plans and in accordance with the manufacturer's requirements. The lateral seam shall have a minimum overlap of 24"

C. Dimensions to be a minimum width of 10' and minimum continuous length of 150'

D. Attached to subgrade per manufacture specifications/recommendation.

3.9 SUBGRADE ESTABLISHMENT

A. The subgrade shall be excavated to create a positive slope towards the subsurface drainpipes at greater that 0.5% for the synthetic turf fields.

B. No work shall be completed in this section until subgrade is 100% completed and accepted by the Landscape Architect and Owner or their representative.

C. Following rough grading of the subgrade, the exposed soil shall be moisture conditioned to near the optimum moisture content and compacted to at least 90 percent relative compaction (modified proctor) to produce a firm non-yielding surface.

D. Subgrade after compaction and inspection shall be covered with an approved geotextile fabric between all drain line locations. Fabric shall be non-woven, and be approved.

E. Loaded trucks shall not be permitted to drive over fabric surface until the base aggregate has been placed accordingly.

F. All aggregate layers to compacted to a minimum 95% of maximum dry density compaction rates.

G. Final subgrade grades shall conform to the existing field grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.04 feet in 25 feet in any direction. Laser grading is required.

H. A North Carolina signed and sealed survey of the finish subgrade is required for review and approval prior to turf installation.

I. If the subgrade does not meet the specification requirements, rework and resurvey will be required.

3.10 SITE PREPARATION

A. The Contractor shall strip all debris and organic matter from areas to be graded for the synthetic turf base.

B. All drain line spoils shall be removed from subgrade and all subgrade areas shall be rolled and compacted to 90% and compaction test results submitted to Synthetic Turf Contractor, Owner and Engineer/Landscape Architect for approval and for the records.

3.11 COMPACTED FILL

A. Place and compact approved fill material in accordance with the specifications and drawings.

B. No fill shall be compacted during periods of rain or on ground that is saturated or has standing water. Soil that has been over-saturated by rain or any other means shall not be used until the moisture content is within limits required by the Owner and Engineer

3.12 PERMEABLE BASE AND TOP STONE

A. Finished surface shall be proof rolled with a vibratory smooth double drum roller to provide a non-yielding, smooth, flat surface. Compaction must be to 95%-modified proctor. Modified proctor testing per current ASTM standards is required. Submit testing procedure to geotechnical engineer for approval.

B. Final crushed rock base grades shall conform to the existing field grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.04 feet in 25 feet in any direction. Laser grading is required.

C. A North Carolina signed and sealed survey of the finish stone base is required for review and approval prior to turf installation.

D. If the stone base does not meet the specification requirements, rework and resurvey will be required.

3.13 PERMABILITY TESTING REQUIREMENTS

A. Base stone (including finishing stone) shall be tested via ASTM D3385 Infiltration Rate of Soils in the field using a Double Ring Infiltrometer (EN12616). Provide ten test locations on each field to be determined by the designer. Permeability for combined stone sections shall be greater than 30"/hr. 3rd Party Testing Required.

B. All systems collectively shall drain vertically a minimum of 20” of rain per hour with no signs of visible ponding. The finish turf surface with infill shall be tested using ASTM F2898 Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-Confined Area Flood Test Method. 3rd Party Testing Required.

1. Each field shall be tested at the completion of the project. There shall be 10 test locations on each field determined by the designer. If one location fails to meet the requirement, the entire field will need to be remediated and retested. It is the contractor's responsibility to fully remediate the field within 30 days of the failing test results or be subjected to a full turf and infill replacement.

3.14 SYNTHETIC TURF

A. Synthetic turf shall be loose laid across the field, stretched, and attached to the perimeter edge detail. Turf shall be of sufficient length to permit full cross-field installation.

B. Turf panels shall either be glued or sewn together.

C. Glued Seams: Panels glued together at the seams using the latest state of the art procedures approve by the manufacturer. Seams shall be adhered using reinforcing tape and high-grade adhesive approved by the manufacturer. All seams shall be transverse to the field direction, i.e., run perpendicularly across the field. Seams shall be flat, tight, and permanent with no separation or fraying.

D. Sewn Seams: Utilizing standard state of the art sewing procedures, each roll shall be attached to the next. Each seam will be stitched using cord as approved by the manufacturer. When all of the rolls of the playing surface have been installed, the sideline areas may be installed at right angles to the playing field turf

3.15 REPAIR MATERIALS, GROOMER AND SWEEPER

A. Upon Final Acceptance, the turf Contractor shall provide to the Owner the following items at the quantities specified.

B. 100 SF attic stock of base field green turf

C. 50 LF of each line color turf

D. 20 LF of seaming tape and epoxy

E. Provide four (4) 55-gallon garbage cans with lids filled with SBR Rubber or Organic Infill

F. Provide four (4) 55-gallon garbage cans with lids filled with Sand

G. Integrated groomer and sweeper combination machine.

H. Pull behind magnet

I. Provide specifications for the type of field utility vehicle tires allowed on the field. Includes this provision in the warranty

3.16 MAINTENANCE TRAINING

A. The Sports Field Manufacturer will be responsible for training the Owners selected personnel regarding the maintenance and upkeep of the field upon completion. The Sports Field Contractor is responsible for scheduling this event and obtaining written confirmation and acceptance of the scheduled time from the owner.

3.17 REQUIRED PERFORMANCE G-MAX AND HIC TESTING

A. Before Final Acceptance the Sports Field Manufacturer shall, as specified, hire an independent testing laboratory to perform G-max and HIC testing (ASTM 355, 1936 method, and HIC EN 1177) testing at a minimum of 10 locations on the field.

B. The Owner reserves the right to have the field tested for shock attenuation at its own cost at any time it deems necessary. If at any time the G-max ranges reach unacceptable levels, it is the responsibility of the Sports Field Contractor to bring the field back into the required ranges at no cost to the Owner.

C. At any time, should the Sports Field Contractor fail to provide an independent third party Gmax test that confirms an average Gmax value of 135G or lower and a HIC critical fall height greater than 1.3 meters, then the Sports Field Contractor will be solely responsible for the remove and dispose of the existing field surface, and the full installation of a new synthetic turf playing surface that meets all the specifications of the original bid documents and is independently tested to be safe by the original Gmax-Shock Attenuation requires as listed within this section.

D. Submit a pdf copy of the test report findings to the Owner at the completion of each test.

END OF SECTION 321823.29

SECTION 321823.40 – ORGANIC INFILL FOR SYNTHETIC TURF FIELDS (ALTERNATE)

Summary:

- Infill shall be an engineered wood particle comprised of virgin natural pine wood grown and manufactured in the USA.
- Infill shall be free of pesticides and heavy metals.
- Infill shall maintain a vertical drainage rate that exceeds that of the artificial turf when tested alone according to test method ASTM 1551.
- Infill shall not materially degrade as an infill defined as a minimum of 80% of the material will fall between sieve screens of .8mm-2mm when tested according to BS EN 933-1:2012.
- Infill shall be made from a species of tree that is sustainably harvested.
- Infill shall be domestically sourced – made in the USA only.
- Infill shall have a minimum of a 10-year warranty.
- Infill must be Cradle to Cradle Certified
- Infill must be hydrophilic and allow absorption of rain or condensation.
- Infill shall not require irrigation and the Owner shall not be required to perform moisture testing of the infill.
- Infill must have a minimum bulk density of 15 lbs / cu ft
- Infill must be installed in at least 100 full sized synthetic turf athletic fields (minimum of 60,000 ft2 each) in the USA within the past 3 years

PART 1 – GENERAL

1.1 DEFINITIONS

A. Natural Infill: Synthetic grass surfacing system infill materials free of Styrene-Butadiene-Rubber (SBR), Crumb Rubber, Ethylene-Propylene-Diene Monomer Rubber (EPDM), Thermoplastic Elastomer (TPE), and metals of any kind.

B. Synthetic Turf Testing Agency (Testing Agency): Agency to perform testing on the synthetic turf system. All testing shall be done by an independent 3rd party testing agency. Performance testing and on-site testing shall be performed by a qualified Testing Agency experienced in performing safety and performance testing with synthetic turf fields.

C. Compatible Product: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's general specifications, installation instructions, and maintenance requirements for all infill material products in the Synthetic Grass Surfacing System, including certifications and other data as may be required, to show compliance with the Contract Documents.

B. Material Testing: Submit for approval test results for all material testing performed under “Quality Control Testing” herein. Provide copies of all Testing Agency reports. Testing shall be no more than 24 months old from date of submittal.

C. Material Samples: Submit three (3) samples for approval for all materials under 2.1 Materials including, but not limited to, the following:

D. Synthetic Grass Surfacing Performance Infill: One-pound sample

E. Synthetic Grass Surfacing Stabilizing Infill: One-pound sample

F. Warranties: Submit a draft copy of the warranties in Owner's name for all products furnished under this section.

G. Post-Installation Submittals

1. Material Testing: Submit for approval test results for all material testing performed under “Quality Control Testing, Post-Installation” herein.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery to minimize on-site storage. Segregate differing materials to prevent contamination between materials.

B. Packing and Shipping: Deliver products in original unopened packaging with legible manufacturers' identification. All materials shall be stored in a dry place out of the direct sunlight.

1. Performance in-fill

a. Shall arrive in large sacks or bags without tears and loose material.
b. Shall arrive dry and loose. No infill shall be accepted that is bulked or solid.
c. Shall be delivered and stored on a solid, level, and clean surface.
d. Cover all materials prior to any rain event.

1.4 QUALITY CONTROL TESTING

A. All testing, unless otherwise noted, shall be completed by an independent (third-party) Testing Agency as approved by Landscape Architect/Architect/Engineer. Testing must be for current materials with current date from independent testing laboratory as described herein.

B. Synthetic Grass Surfacing Performance Infill Material

ASTM F3188	PERFORMANCE INFILL SOLUBLE THRESHOLD LIMIT CONCENTRATION	PASS
EN 933	PERFORMANCE INFILL BULK DENSITY	>15 lbs./ cu. ft.
EN 14955	PERFORMANCE INFILL PARTICLE SIZE	< 1 SIEVE SIZE CHANGE COMPARED TO MANUFACTURER'S DECLARATION
EN 1097-3	PERFORMANCE INFILL PARTICLE SHAPE	SAME SHAPE
EN ISO 20105-A02	PERFORMANCE INFILL ARTIFICIAL COLOR FASTNESS (CHANGE) - ARTIFICIAL WEATHERING	> GREY SCALE 3, NO CHANGE IN SHAPE

C. Post-Installation Testing

ASTM F3188	STABILIZING INFILL SOLUBLE THRESHOLD LIMIT CONCENTRATION	PASS
EN 933/ FIFA TEST METHOD 20	STABILIZING INFILL BULK DENSITY	WITHIN 95% COMPARED TO SUPPLIERS DECLARATION
EN 14955	STABILIZING INFILL PARTICLE SIZE	< 1 SIEVE SIZE CHANGE COMPARED TO MANUFACTURER'S DECLARATION
EN 1097-3	STABILIZING INFILL PARTICLE SHAPE	SAME SHAPE

1.5 WARRANTY

A. Synthetic Grass Infill Warranty

1. The Contractor shall provide a non-prorated Warranty/Guarantee (also referred to herein as the Warranty) for the synthetic grass infill materials and installation as specified herein, for a minimum of ten (10) years from the infill supplier/manufacturer to the Owner from the date of Certificate of Substantial Completion.
2. The warranty shall include the following:
    a. Infill material shall be free of pesticides and heavy metals, and processed in a way that destroys all mold, mildew, bacteria, insects and fungus and naturally inhibits the growth of new mold, mildew, bacteria, insects and fungus on the surface
    b. Infill Material shall maintain a vertical drainage rate that exceeds that of the artificial turf when tested alone according to test method ASTM 1551
    c. Infill material shall not degrade as an infill such that a maximum of 20% of the material will pass through a .5 mm screen when tested according to BS EN 933-1:2012
    d. The field will meet the performance parameters set forth in this document for Shock Absorption, Vertical Deformation, Head Injury Criteria, and Rotational Resistance (collectively the “Standard”) at the time of installation. If the field fails to meet the Standard within 90 days of completion, the infill manufacturer shall guarantee to bring the field into compliance including materials and labor as required to do so.
    e. The warranty shall not be conditional of the moisture content of the infill material and the Owner shall not be required to perform moisture testing or irrigation of the infill.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
2. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
3. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
4. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product. All submitted equal products must be wood based.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
    a. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
2. Product: Where Specification name performance requirements for product, provide product that complies with requirements.
    b. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

2.2 MATERIALS

A. Synthetic Grass Surfacing Infill

1. Shall consist of a mixture of a stabilizing infill and a performance infill as follows:
    a. Stabilizing Infill: Silica sand material
    b. Performance Infill: Natural infill material
2. Performance infill shall consist of natural infill material meeting the following requirements:
    a. Free of Styrene-Butadiene-Rubber (SBR), Crumb Rubber, Ethylene-Propylene-Diene Monomer Rubber (EPDM), Thermoplastic Elastomer (TPE), and metals of any kind.
    b. Bulk density > (greater than) 15 lbs./ cu. ft.
    c. Be hydrophilic and allow absorption of rain or condensation.
    d. Be Cradle to Cradle Certified
    e. Meet all requirements under Section 1.4 Quality Control Testing
    f. Meet the requirements as specified under Section 1.5 WARRANTY
    g. Shall not require the monitoring of the materials moisture content under the terms of the warranty and/or maintenance obligations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Synthetic Grass Surfacing Infill

1. Infill ratio and installation in lifts shall be based manufactures recommendation.
2. Installer shall allow for adequate time and proper machinery to properly groom infill material into the synthetic grass carpet fibers.
3. Infill Materials shall be uniformly filled to a depth which leaves no more than xx" of exposed pile after settlement and provides the system meets the performance and safety criteria set forth in this document.

END OF SECTION 321823.40

SECTION 322200 – RESILIENT UNDERLAYMENT - ALTERNATE

Summary:

This document defines requirements for the installation and operating performance of an athletic field synthetic base underlayment material needed for a professional-grade synthetic turf field. Defined are the primary system requirements for insuring quality, environmental compatibility, optimum safety of the playing surface (impact attenuation/surface playability) and high-capacity subsurface drainage of the installed playing field.

Specifications listed are defined per applicable ASTM standard test methods, or other national or internationally recognized testing standards. All other specifications and tolerances listed shall be defined under standard ANSI and/or ISO drawing and specification rules.

Note: This specification requires prior installation of stabilized subsurface base, including a perimeter foundation-grade concrete curb and high-capacity trenched storm drain system.

PART 1 - SPECIFICATION REFERENCES

1.1 RELATED SPECIFICATION SECTIONS

A. Section 321823.19: Synthetic Turf System

PART 2 - TESTING REFERENCES

2.1 American Society for Testing and Materials (ASTM), International Standards Organization (ISO), European Committee for Standardization (EN), German Institute for Standardization (DIN), Environmental Protection Agency (EPA):

ASTM D3574-08 Test E	Standard Specification for Flexible Materials - Tensile Strength, Tensile Elongation
ASTM D3575-08, Test D	Flexible cellular polymeric materials - Determination of Compression Strength
ASTM D696	Determination of Coefficient of Linear Thermal Expansion
ISO 62:2008 DIN 53428	Standard Test Method for Water Absorption of Plastics
ASTM 1551: DIN 18-035, Part 6	Water Permeability of Synthetic Turf Systems and Permeable Bases
ASTM F355-16	Standard Test Method for Impact Attenuation of Playing Surface

Missile E	Systems, Other Protective Sport Systems, and Materials Used for Athletics, Recreation and Play
ASTM F3146-18	Standard Test Method for Impact Attenuation of Turf Playing Surface Systems Designated for Rugby
ASTM F355-16 Missile A	Standard Test Method for Impact Attenuation of Playing Surface Systems, Other Protective Sport Systems, and Materials Used for Athletics, Recreation and Play
ASTM F3189-17	Standard Method for Measuring Force Reduction, Vertical Deformation, Energy Restitution of Synthetic Turf Systems Using the Advanced Artificial Athlete
EN 14808:2005	Surfaces for Sports Areas. Determination of Shock Absorption
EN 14809:2005	Surfaces for Sports Areas. Determination of Vertical Deformation
ASTM F1936-10	Standard Specification for Impact Attenuation of Turf Playing Systems as Measured in the Field
ASTM F925	Test Method for Resistance to Chemicals of Resilient Flooring
ASTM G22	Determining the Resistance of Plastics to Bacteria
ASTM G21	Determining Resistance of Synthetic Materials to Fungi
ISO 14001:2004	Environmental Management Systems
ISO 9001:2008	Quality Management Systems
EPA 6010B, 7470A, 7471A	Heavy Metals, Mercury
EPA 8260B	Volatile Organics
EPA 8270C	Semi-Volatile Organics

PART 3 - SUB-BASE SYSTEM DESCRIPTION

3.1 General Requirements for Underlayment System – An impact energy absorbing sub-base drainage system designed specifically for use with synthetic turf is required. The specified material must have physical, drainage and performance properties that meet the following requirements:

A. Minimum material nominal thickness 17 mm – material thickness must be within ± 1.5 mm

B. Tensile Strength > 45 psi (ASTM D3574-08 Test E)

C. Tensile Elongation > 10% (ASTM D3574-08 Test E)

D. Compression Strength > 25 psi @ 25% strain (ASTM 3575-08 Test D)

E. Linear Thermal Expansion < 0.10 mm /m /° C (ASTM D696)

F. Water Absorption £ 5% after 24 hrs (ISO 62:2008 / DIN 53428)

G. Water Permeability > 500 in/hr (ASTM 1551 DIN 18-035, Part 6)

H. Head Injury Criterion < 1,000 from > 0.6 m drop height (ASTM F3146-18, Procedure A)

I. Gmax < 120 g (ASTM 355-16 Missile A)

J. Shock Absorption > 55% (EN 14808:2005 / ASTM F3189-17)

K. Vertical Deformation < 4.0 mm (EN 14809:2005)

L. Resistance to Chemicals £ 2 (ASTM F925)

M. Resistance to Bacteria - no growth (ASTM G22)

N. Resistance to Fungi – no growth (ASTM G21)

Impact Safety Requirements for installed Surface System of Infilled Synthetic Turf and Underlayment:

O. Surface system must provide maximum average Gmax of 110 g upon initial testing of installed field (ASTM F1936-10)

P. Surface system must provide maximum average Gmax of field of 120 g during warranty period of artificial turf (ASTM F1936-10)

PART 4 - QUALITY ASSURANCE AND GUARANTEES

4.1 Product must be made in ISO accredited facility in the United States of America according to the Federal Trade Commission Made in USA Standard.

4.2 Material must be manufactured in an ISO 9000:2008 certified facility.

4.3 Product must be of consistent material composition. Variable content material will not be accepted.

4.4 Manufacturer must provide documentation of material content and pre-approved standard OSHA MSDS sheet.

4.5 Manufacturer must demonstrate successful athletic field installation in the United States of at least 40 million square feet (approx. 500 fields) over a minimum period of 10 years.

4.6 Material must be covered by a pre-approved and binding 16-year limited product and performance warranty issue by a company in the United States of America. Warranty shall include the provision that manufacturer will deliver to the Owner and install new panels to replace the non-conforming panels. The installation shall include the temporary removal and repair or replacement of the artificial turf and infill over the affected area.

4.7 Warranty must specify static and dynamic load limits in pounds and pounds per square inch. Warranty must not specify monetary limits of liability. Warranty must allow owner a notice period of at least 30 days for non-compliance claims.

4.8 Warranty must include guarantee for surface system Gmax ≤120 G's according to ASTM F1936-10 for warranty period of artificial turf.

4.9 Manufacturer must provide third-party laboratory data demonstrating that a surface system comprising the underlayment product beneath a 2" turf system with sand and SBR infill (at least 60% sand by weight, and no more than 6 lb/sq ft of infill in total) will produce a critical fall height (CFH) of ≥ 1.3 m after 8 years of simulated wear using a Lisport XL (6020 cycles), when tested over a concrete floor and in accordance with ASTM F3146.

4.10 Product must be designed to freely drain and not designed to hold or retain water. Any product that intentionally holds or retains water will not be accepted.

4.11 System seams should be mechanically locked into place by hand without cutting, splicing, use of additional materials, glue, fasteners, or secondary processes and equipment.

4.12 Material must be installed according to manufacturer's instructions, without exceptions.

4.13 Manufacturer must provide written procedures to selected turf supplier or contractor for the installation of turf on top of underlayment.

4.14 Product is to be shipped as flat panels on pre-packaged pallets. .

PART 5 - ENVIRONMENTAL COMPATIBILITY

5.1 Material must be manufactured in an ISO 14001:2004 certified facility.

5.2 Product must not contain concentrations of metals, volatile organic compounds (VOCs), or semi-volatile organic compounds (SVOCs) at concentrations greater than EPA Regional Screening Levels or Department of Toxic Substances Control Human Health Risk Assessment (HHRA) Note 3 thresholds. (EPA 60108, EPA 7470A EPA 7471A, EPA 8260B, EPA 8270C).

5.3 Product must not contain leachable concentrations of metals, VOCs, or SVOCs (using the synthetic precipitation leaching procedure) greater than maximum contaminant levels (MCLs) or Regional Water Quality Control Board Environmental Screening Levels for groundwater and surface water - fresh water aquatic habitat. (EPA 60108, EPA 7470A EPA 7471A, EPA 8260B, EPA 8270C).

Additional Requirements for California:

5.4 Product must not contain a chemical on the current California Proposition 65 Safe Drinking Water and Toxic Enforcement Act of 1986 - Update effective 06 JUNE 2014

5.5 Product must not contain concentrations of substances at hazardous waste levels per California Code of Regulations, Title 22, Division 4.5, Chapter 11 – Identification and Listing of Hazardous Waste.

PART 6 - SUBMITTALS

6.1 General: Bidding contractor must identify performance base system with bid package. If a non-specified product is identified, the proposed alternate product must be submitted and pre-approved by the design architect/engineer 10 days prior to the bid opening. If bidding contractor does not identify a manufacturer, the Township/School District will assume that the specified product is included in the bid package and will not consider substitutions.

6.2 Product Data: Submit 8” x 12” product sample and typical properties sheet.

6.3 Shop Drawings: Submit cross-sectional view showing product installation in relation to sub-base and synthetic turf (including edge attachment).

6.4 Test Data: Submit all applicable test data for compliance to specifications. All testing to be performed following applicable ASTM or other internationally recognized standards and procedures.

6.5 Installation: Submit copy of product installation instructions and manufacturer recommendations.

6.6 Warranty: Submit copy of product 16 -Year warranty coverage as specified in 4.6 – 4.8.

PART 7 - PRODUCTS

7.1 Description: Resilient Expanded Polypropylene Shock Pad Material.

7.2 Product: Brock Shock Pad Series 17 or pre-approved equal.

7.3 Contact Information:
Brock USA LLC
3090 Sterling Circle
Boulder, CO 80301
Telephone: (303) 544-5800
sales@brockusa.com
www.brockusa.com

Ronnie Pascale
National Director of Sales

Telephone: (804) 366-1368
rpascale@brockusa.com

7.4 Manufacturing/Ordering Information:
Brock USA LLC
3090 Sterling Circle
Boulder, CO 80301
Telephone: (303) 544-5800
sales@brockusa.com

7.5 Product format: Interlocking panels
Size: approximately 67.25 x 47.5 inches (1708 x 1207 mm) overall dimensions
Area: Net coverage per panel 21.0 ft^2 (1.95 m^2)
Thickness: 0.67" (17 mm) ± .08"
Panel Weight: approximately 4.3 lbs / panel

PART 8 - PRODUCT SUBSTITUTIONS

8.1 Product substitutions are allowed only in accordance with pre-bid substitution request procedures outlined in the contract documents. No substitutions will be allowed after the bid date. Bidding contractor must identify performance base system with bid package. If a non-specified product is identified, the proposed alternate product must be submitted and pre-approved by the design architect/engineer 10 days prior to the bid opening. If bidding contractor does not identify a manufacturer, the Client will assume that the specified product is included in the bid package and will not consider substitutions.

8.2 Proposed alternate resilient underlayment pads, must show a United States FIFA Quality or higher certification for a system that includes the proposed pad and organic wood infill within the past two years.

PART 9 - INSTALLATION

9.1 Per manufacturer's recommendation - obtain written installation instructions and procedures from the manufacturer.

PART 10 - SURPLUS MATERIAL

10.1 Surplus materials to be determined by the Owner prior to order and delivery of product to the installation site. Surplus quantities to be identified in writing by the General Contractor at the time of order placement.

PART 11: PROJECT COMPLETION

11.1 Upon completion of installation, a walk-through will be conducted to inspect the quality of work and ensure all details meet specifications.

11.2 A punch list of unacceptable or incomplete items will be documented and agreed upon for completion prior to final project closeout and acceptance.

PART 12 - APPROVALS

12.1 Finished synthetic base installation workmanship must be approved in advance by the turf manufacturer. Approvals to be based on a physical inspection performed at the site prior to installation of any synthetic turf material.

12.2 Any approvals sought after turf installation will be declined. Any associated repair or replacement costs associated with rework of the synthetic base will be the responsibility of the turf supplier/installer.

END OF SECTION 322200

SECTION 323113 – BLACK VINYL CHAIN LINK FENCING 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. Vinyl Chain-link fences and gates

B. Related Sections:

1. Concrete Paving
2. Synthetic Turf System

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Chain-link fence shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 6 feet high, and post spacing not to exceed 10 feet.
2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:

    a. Wind Loads: 105 mph.
    b. Exposure Category: B.
    c. Fence Height: Varies
    d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe or stronger if warranted to meet wind load requirements. Contractor to verify prior pipe material prior to bid and installation.

B. Fence posts, footers and fabric not structurally designed for wind/privacy screen applications. Any wind/privacy screens installed after construction will be at the owner's discretion and risk.

C. Fence system shall meet all applicable ASTM standards. Including but not limited to

1. F 668 - Specification for Poly (Vinyl Chloride)/(PVC) - Coated Steel Chain Link Fabric
2. F 567 - Practice for Installation of Chain Link Fence

3. F 669 - Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence
4. F 900 - Specification for Industrial and Commercial Swing Gates
5. F 934 - Standard Colors for Polymer-Coated Chain Link Fence Materials
6. F 1083 - Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
7. F 1234 - Specification for Protective Coatings in Steel Framework for Fences

1.4 SUBMITTALS

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

1. Fence, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Product Certificates: For each type of chain-link fence from manufacturer.

D. Product Test Reports: For framing strength, according to ASTM F 1043.

E. Field quality-control reports.

F. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Polymer finishes.

G. Warranty: Sample of special warranty.

H. Other Informational Submittals:

1. Record drawings.

1.5 QUALITY ASSURANCE

A. In general, conform to standards of the CHAIN LINK FENCE MANUFACTURERS INSTITUTE (CLFMI). Manufacturer:

B. Company specializing in commercial quality chain link fencing with five years' experience.

C. Installer: Company specializing in commercial quality chain link fence installation with three years' experience and approved by manufacturer.

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. All material and workmanship shall be warrantied for a period of one (1) year after final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

B. The types of fencing required for the project are as indicated below, subject to detailed material requirements which follow.

1. All fencing materials shall be black in color.
2. All material shall be new, and products of recognized reputable manufacturers. Used, re-rolled or re-galvanized materials are not acceptable.
3. Like items of materials provided hereinafter shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
4. Fencing Fabric Wire shall conform to the following:

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

	Core (inches)	Wire (uncoated) (gauge)	Wire Breakload (lbf)	Mesh Size
Fence Fabric	0.148	9	1290	1.75”

   c. All fencing is to be knuckle – knuckle (no barbs top or bottom)

5. Powder coated framework shall be steel pipe high strength – Type II: Cold formed and welded steel pipe complying with ASTM F1043, 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.

6. Schedule of pipes sizes shall be as follows:

Application	Height (feet)	Outside Dimensions (inches)	Wall Thickness (inches)	Weight (lbs/foot)
Terminal/Corner Posts	ALL	4.00	0.160	6.56
Line Posts	Under 5'-0"	1.900	0.120	2.28
	5'-0"to 8'-0	2.875	0.160	4.64
All Rails and Braces	(all heights)	1.660	0.111	1.84

7. Post tops shall be provided with secured post caps that fit tightly and cannot be removed by hand.
8. 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.
9. Provide top rail with pass-through fittings at line posts and rail end cups and brace bancs at terminal or gate posts.
10. 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.

    a. Where the chain link fence is in line with the Protective Ball netting, special boulevard clips shall be used to allow for the field side of the ball net post and the chain link fence post to be flush with each other. This means the posts will not be lined up center to center, but rather will be offset from each other to have a flush fabric condition on the field side.

11. 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.
12. 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.

    a. Where the chain link fence is in line with the Athletic Ball Netting, special boulevard clips shall be used to allow for the field side of the ball net post and the chain link fence post to be flush with each other. This means the posts will not be lined up center to center, but rather will be offset from each other (see Project Drawings and Details).
    b. Stretcher Bars shall not be less than three sixteenth's (3/16") of an inch by three quarter's of an inch (¾") 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.

c. 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.
d. 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.
e. 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 ¼”) galvanized carriage bolts with nuts, ASTM A-307, Grade A.
f. Other hardware required shall be fabricated from steel, and galvanized in accordance with ASTM A123 and/or ASTM A153.
g. All threaded bolts are to be turned away from secured areas, especially field of play

C. Chain Link Swing Gates:

1. All gates to be heavy duty commercial grade.
2. 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.
3. Chain link fabric for gates shall match fabric for fencing.
4. Gate posts shall be steel pipe – type II finished to match fence posts:

Double Leaf Gates	Post Size (inches)	Weight (lb/ft.)
8’-12’ wide	4.00	5.79

Single Gates	Post Size (inches)	Weight (lb/ft.)
4’-6’ wide	2.875	4.64
All gate frames	1.66	1.84

5. Gate hinges shall be heavy-duty offset type. Install gate with 90 degree malleable heavy duty hinges. 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.

6. All gates should open outward away from the field of play.
7. All gates shall be equipped with a positive closure latch and padlock fitting.
8. Lockable latches are required on all walk and double gates.
9. All threaded bolts are to be turned away from secured areas, especially field of play.

2.2 CAST-IN-PLACE CONCRETE

A. Materials: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94/C 94M. Measure, batch, and mix Project-site-mixed concrete according to ASTM C 94/C 94M.

1. Concrete Mixes: Normal-weight concrete with not less than 4000-psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.

B. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

2.3 SHOP DRAWINGS

A. Contractor to provide full shop drawings and specifications for approval of all fencing, gates and components. Drawings to include all details, layouts, post locations and clear widths of all gates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, 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 owner’s representative.

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.

1. Install fencing on established project boundary lines inside property line as shown on Drawings.

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. Where the chain link fence is in line with the Athletic Ball Netting, special boulevard clips shall be used to allow for the field side of the ballnet post and the chain link fence post to be flush with each other. This means the posts will not be lined up center to center, but rather will be offset from each other. (see Project Drawings and Details).
3. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
    b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.
    c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
    d. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
4. Mechanically Driven Posts: Drive into soil to depth shown on details. Protect post top to prevent distortion.

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 30 degrees or more.

D. Line Posts: Space line posts uniformly on center per detail.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. 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.

G. Intermediate and Bottom Rails: Install and secure to posts with fittings.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. 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.

J. 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 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

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 per manufacturer requirements. 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 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. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 328423 - IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide an automatic underground irrigation system as shown and specified. The work includes installation of an underground irrigation system for the Academy Complex irrigation system.

1. Obtaining and paying for permits, fees, inspections and tests required for the installation of an underground irrigation system.
2. Providing valves, piping, sprinklers, fittings, and accessories as indicated.
3. Performing excavating, backfilling, and pipe pulling to install the system.
4. Providing controller and accessories to complete the system interior and exterior.
5. Testing and demonstration.

1.3 PRICING PACKAGE

A. **Base Bid** – Provide irrigation products as specified and approved equals.

1.4 QUALITY ASSURANCE

A. Installer's qualifications: Single firm specializing in irrigation work with a minimum of (10) ten years' experience installing irrigation systems of comparable size. The Contractor must provide a list of five (5) projects of similar size, complete with contact names and phone numbers.

B. Materials, equipment, and methods of installation shall comply with the following codes and standards:

1. The Cabarrus County Plumbing Requirements and Conditions
2. American Society for Testing and Materials, (ASTM).
3. National Sanitation Foundation, (NSF).
4. North Carolina Irrigation Contractor Licensing Board
5. Minimum Irrigation Standards.
6. The Irrigation Association

C. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, plantings and architectural features.

D. All work called for on the drawing by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.

E. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade difference or discrepancies in area dimensions exist that might not have been known in engineering. Any discrepancies are brought to the attention and reviewed by the Owners representative. The Contractor shall have a Project Manager on the job site during all installation work.

1.5 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each of the system components.

B. Submit shop drawings for the irrigation system. Include piping layout and details illustrating location and types of sprinkler heads, valves, control systems and wiring, and list of fittings. Show sprinkler head coverage. (If other than specified)

C. Submit product data for each type of product required for approval.

D. Upon irrigation system acceptance, submit written operating, maintenance and winterization instructions. Provide format and contents as directed by the Owner.

E. Upon completion of the project, the Contractor shall submit to the Owner or Owner's representative prior to the final acceptance of the project, one final, reproducible "as-built" drawing and computer generated AutoCAD drawing on diskette or CD-recordable disc prepared by a qualified AutoCAD designer. The Owner or Owner's reserve the right to reject "as-built" submittals if "as-built" is not complete or legible.

F. The Contractor shall dimension from two (2) permanent points of reference, i.e. building corners, sidewalk or road intersections.

1. Connection to existing water lines (point of connection)
2. Routing of sprinkler pressure lines (dimension max. 100ft. along routing)
3. Sprinkler control valves
4. Quick coupling valves
5. Gate valves
6. Other related equipment as directed by Owner or Owner's Representative

G. The Contractor shall also indicate any non-pressure pipe routing changes on the "as-built" drawing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.

C. Store and handle materials to prevent damage and deterioration.

D. Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced, to prevent installation delays.

1.7 PROJECT CONDITIONS

A. Locate existing underground utilities in areas of work. If utilities are to remain, provide adequate means of protection during the system installation. Repair utilities damaged during the work to the satisfaction of the utility owner and at the Contractor's expense. Notify local Utilities Protection Service 2 working days prior to beginning excavation work.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, notify the Owner or Owner's representative immediately for direction as to procedure. Cooperate with Owner and utility companies in keeping active services and facilities in operation.

C. The Contractor shall be responsible for the preservation and protection of all trees, plants, monuments, structures and paved areas from damage due to this work. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to the satisfaction of the Owner, and all injury to living plants shall be repaired by the Owner or such persons as he may employ to accomplish this work. All the costs of such work shall be charged to and paid promptly by the Contractor.

D. Promptly notify Owner of unexpected subsurface conditions.

E. Irrigation system layout is diagrammatic. Exact locations of piping, sprinkler heads, valves, and other components shall be established by Contractor in the field at time of installation.

1. Space sprinkler components as indicated on drawing.
2. Minor adjustments in system layout will be permitted to clear existing fixed obstruction, final system layout shall be acceptable to the Owner.

F. Cutting and Patching:

1. Cut through concrete and masonry with core drills, Jack hammers are not permitted.
2. Materials and finishes for patching shall match existing cut surface materials and finish. Exercise special care to provide patching at openings in exterior walls water tight.
3. Methods and materials used for cutting and patch shall be acceptable to the Owner or Owner's representative

1.8 WARRANTY

A. During the period of one (1) year from and after the final acceptance of the completed irrigation system, the Contractor shall at his own expense, make all needed repairs or replacement due to

defective workmanship or materials which in the judgment of the Owner or Owner's representative, shall become necessary during such period. If, within seven (7) calendar days after mailing of a written notice or verified communication by the Owner to the Contractor or his agent, requesting such repairs or replacement, the Contractor shall neglect to make repairs, Owner may make such repairs at the Contractor's expense. In the case of emergency where, in the judgment of the Owner, delay could cause serious loss, hazard or damage to persons or property, then repairs, replacement and security, both temporary and /or permanent, may be provided by such persons as the Owner may employ, after verbal communication with Contractor without notice being sent to the Contractor, and the Contractor shall pay all costs related thereto.

B. Contractor and Owner recognize that vandalism is a potential problem. Any vandalism before final acceptance, up to $500.00 shall be borne by Contractor, while vandalism $500.00 and over shall be divided equally between Contractor and Owner.

1.9 COORDINATION

A. Coordinate work of this Section with that of other trades, under this and other Contracts with the Owner, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Landscape Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

C. Do not interrupt existing services without Owner’s approval. Schedule interruptions in advance, according to Owner’s instructions. Interruptions shall be scheduled at such times of day and work so that they have minimal impact on Owner’s operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Equipment Manufacturer: As shown on drawings or approved equal.

B. Manufacturer’s Qualifications: Irrigation products (i.e.: all sprinklers, all valves, all controllers,) shall be by a single manufacturer. All irrigation system components shall be supplied by the regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all respect.

C. Any request for accepted equivalent shall be submitted in writing to Owner or Owner's representative seven (7) days prior to start of construction. Request shall include manufacturer's cut sheets, performance data, and list of five (5) projects similar in nature in which product or products have been installed during the last two (2) year period. Owner or Owner's representative shall respond to request within three (3) days of receipt.

2.2 MATERIALS

A. General:

1. Provide only new materials, without flaws or defects, and of highest quality of their specified class and kind.
2. Comply with pipe sizes indicated. No substitution of smaller pipe than shown on plan will be permitted. Larger sizes may be used subject to acceptance of the Owner or Owner's representative. Remove damaged and defective pipe from the site.
3. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (NSF) approval.

B. Plastic pipe, fittings, and connections:

1. Polyvinyl chloride pipe: ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents.
   a. 1"- 3” diameter pipe : SDR 21, Class 200 solvent weld
   b. 4”- 6” diameter pipe : SDR 21, Class 200 gasketed pipe
   c. All mainline pipe shall be SDR21 Class 200 gasketed pipe

2. Pipe fittings: 2 1/2” diameter and under, ASTM D2241 schedule 40 PVC molded fittings suitable for solvent weld, slip joint seal, or screwed connections. Fittings made of other materials are not permitted.
   a. Size slip fitting socket taper to permit a dry unsoftened pipe end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted.
   b. All threaded PVC fittings shall be SCH 80.
   c. Use of male adapters will not be allowed.

3. Mainline Fittings: 3” diameter and over, ductile iron fittings grade 65-45-12 ASTM A-536. Fittings shall have deep bell push joints with gaskets meeting ASTM F-477. Approved ductile iron fittings shall be Harco or Leemco.

   NOTE: Transition gaskets are not permitted.

C. Large Sports Rotors

1. The rotor body, stem and nozzle, shall be constructed of heavy-duty and ultra-violet resistant plastic.
2. Shall have a heavy-duty stainless steel retract spring for positive pop-down.
3. Shall have a brass reinforced turret for increased side impact durability.
4. Shall have a non-strippable drive mechanism to prevent damage from vandals.
5. Shall have the Rain Bird® Memory Arc™ feature to return the rotor to its original arc setting.
6. Shall have integrated seals and method for clearing debris.

a. Oversized pressure activated wiper seal prevents leaks and protects internals from debris.
b. Precision controlled flush at pop-down to clear debris from the unit, to assure positive stem retraction in all soil types.

7. Left and right-side adjustable trips allow easy arc alignment.
8. Full and part circle in one unit. Reversing 50-330° arc adjustment through the top of the rotor requires only a flat blade screwdriver or non-reversing full 360° rotation.
9. 10.13-inch body height; 5.0 inch pop-up height (measured to center of nozzle).
10. Operating range of 39 to 81 feet.
11. Operating pressure range of 50 to 100 psi.
12. Shall have a precipitation rate of 0.48 to 1.28 in/hr.
13. Shall include check valve (Rain Bird® Seal-A-Matic™ (SAM)) with up to 10 feet of elevation hold up.
14. Shall include a stainless-steel riser stem to deter vandalism on public turf areas and prevent scoring of stem from debris preventing leaks.
15. Exposed surface diameter shall measure 2.1 inch.
16. Shall include 1 inch NPT female threaded bottom inlet.
17. Shall be available with twelve nozzles with indicated flow rates from 3.8 to 36.3 gpm and an exit trajectory of 25°.
18. All rotor body components shall be removable from the top without special tools in order to provide quick and easy flushing and maintenance of the sprinkler.
19. Shall include slot in cover for use of a pull up tool for ease of nozzle installation and replacement.
20. Shall include nozzle retention screw that may also be used to reduce spray radius by 25%.
21. Shall have a filter screen in the stem to protect the drive from clogging and to simplify removal for cleaning and flushing the system.
22. Shall utilize 3-port Rain Bird® Rain Curtain™ nozzles with micro-ramp technology to deliver even distribution over the entire radius including large wind resistant droplets and gentle close-in-watering.
23. Shall include a five-year trade warranty.
24. Large Rotor shall be the Rain Bird 8005 manufactured by Rain Bird® Corporation, Azusa, California.

D. Irrigation Controller

1. Irrigation controller specifications include but are not limited to:
   a. The controller shall be of a hybrid type that is microelectronic circuitry capable of fully automatic or manual operation.
   b. The controller shall be housed in a wall-mountable, weather resistant plastic cabinet with a key-locking cabinet door suitable for outdoor installation.
   c. The controller shall have a base station capacity of 8 or 12 stations with three slots capable of receiving 4, 8, or 12 station expansion modules for a controller capacity of up to 48 stations.
   d. All stations shall have the capability of independently obeying or ignoring the weather sensor as well as using or not using the master valve.

e. The weather sensors shall include but are not limited to a rain/freeze sensor, a rain sensor for monitoring rainfall, and a anemometer with pulse monitor. The controller shall be compatible with a control device that enables weather-based management.
f. The controller shall have 4 separate and independent programs which can have different start time, start day cycles and station run times.
    1) Each program shall have up to 8 start times per day for a total of 32 possible start times per day.
    2) The programs shall be allowed to overlap operations based on user-defined settings which control the number of simultaneous stations per program and total for the controller.
g. The controller shall come standard with a feature which allows the user to define up to five 24 VAC, 7VA solenoid valves to operate simultaneously.
h. The controller shall have a cycle and soak water management feature which is capable of operating each station for a maximum cycle time and a minimum soak time to reduce water run-off.
i. The controller shall incorporate a flow manager feature that shall provide real-time flow, power, and station management; a flow sensor module option; and a flow sensor module which learns the normal flow rate of each station.
j. The controller shall be compatible with a specified central control system utilizing specialized network communication cartridges with 2 years of IQ4 cellular service.
k. Shall include a 1-year trade warranty.

2. Controller shall be provided in a wall mount enclosure.
3. The controller shall be manufactured by Rain Bird Corporation model ESPLXME with flow and IQ model.

E. Electric Control Valves:

1. Remote control valve for turf areas 50-200 gpm maximum 200 psi. Irrigation valve specifications include but are not limited to:
    a. The valve body and bonnet shall be constructed of heavy-duty and ultra-violet resistant plastic.
    b. The bonnet shall be assembled to the body using multi-drive screws for use with flathead, Phillips, or hexagonal tools.
    c. Shall possess a water tight seal between the body and bonnet.
    d. Shall be a normally closed, forward flow design.
    e. Shall have a filtered pilot flow to resist debris and clogging.
    f. Shall be slow closing to prevent water hammer from causing subsequent system damage.
    g. Shall have a 1 inch to 2 inch NPT globe inlet as well as a 1 inch to 2 inch NPT outlet.
    h. Shall have a manual internal bleed capability to operate the valve without allowing water into the valve box.
    i. Shall have an external bleed to permit flushing of debris from the system.
    j. Shall have a flow control handle to adjust water flow as needed.
    k. Shall include a 24 VAC 50/60 Hz solenoid capable of 2-wire operation.
        1) Inrush current: 0.41A at 60Hz
        2) 2. Holding current: 0.14A at 60Hz

l. Operating flow rate of 50-200 gpm.
m. Operating pressure range of 20-200 psi.
n. Water temperature: Up to 150°F
o. Ambient temperature: Up to 150°F.
p. Shall accommodate an optional field-installed pressure regulating dial.
q. Shall accept an optional latching solenoid for use with battery operated controllers.
r. Shall be available with an optional purple flow control handle for use with non-potable water applications.
s. Shall have a heavy-duty stainless-steel spring for positive diaphragm closure.
t. Shall include be manufactured by Rain Bird corporation model PEB or approved equal.

F. Control Wire

1. All control wire shall be single strand 14-1 PE cable and consist of one hot (RED) and one common (WHITE) wire from irrigation controller to each electric valve.
2. Include four 14-1 (BLUE) tracer wire that home runs from irrigation controller to zone 11 on irrigation system.
3. Wire shall be manufactured by Regency Wire or approved equal.

G. Gate Valves / Backflow Preventer:

1. Gate Valve for electric valve assembly shall be manufactured by NIBCO model number T-FP-600A or approved equal.
2. Mainline Gate Valve shall be manufactured by NIBCO model number P619-RW or approved equal.
3. The irrigation backflow preventer shall be manufactured by ZURN model number 975XL Reduced Pressure Principal Assembly.
4. Backflow Preventer cover shall be manufactured by strong box model number SBBC-30SS and PBB30 Insulation cover.

H. Pipe Sleeves

1.

Pipe Size	Sleeve Size	Sleeve Type
2” to 2-1/2”	4-inch	Sch. 40 pipe
3 inch	6-inch	Sch. 40 pipe
4 inch	8-inch	Sch. 40 pipe
6 inch	10-inch	Sch. 40 pipe

(Sleeve sizes and locations are based on a single pipe being installed in a sleeve. Contractor shall verify sleeve sizes with drawing.)

I. Rain Sensor

1. Irrigation controls shall incorporate a rain sensor to cancel the irrigation program if a preset amount of rain has fallen. Rain sensor shall use a water-absorptive material to

measure rainfall, and have a U.V. stabilized thermoplastic switch housing and aluminum mounting bracket. Sensor shall be adjustable from 1/8"-1". The rain sensor, shall be manufactured by Hunter Industries, or Rain Bird.

J. Grounding

1. The controller shall be grounded to 10 OHMS or less to insure proper surge and lightning protection. Grounding system shall include U.L. listed 5/8" x '10 copper clad ground rod; 4"x 96" grounding plate with '25 of #4 bare copper wire and 100 pounds of grounding enhancing material and Cadweld GT1161G igniter.

K. Master Valve and Flow Sensor assembly

1. Located outside of the time building shall be a 2” Rain Bird EPB-CP normally closed master valve.
2. The master valve shall be installed below grade connecting to the 3” mainline pipe.
3. The master valve shall be installed inside in a separate jumbo valve box.
4. A 2” Creative Sensor Technology FSI-T20-001 flow sensor shall be installed downstream of the master valve with a straight run minimum 5x pipe diameter distance from the master valve and 10x pipe diameter on the discharge of the flow sensor.
5. A P7171D-REV5 shielded communication cable shall be used to connected the output signal from the flow sensor to in input signal of the irrigation controller. The irrigation controller has have the necessary hardware to properly communicate with the creative sensor technology flow sensor.
6. The flow sensor shall be installed in a separate jumbo valve box.

L. Irrigation Point of Connection

1. The point of connection shall be a 2” domestic water meter with the ability to produce 75 GPM at 93 PSI.
2. Contractor to test and confirm adequate pressure is available as shown on irrigation plan.

2.3 ACCESSORIES

A. Splice Kits

1. Low voltage wire connectors: As manufactured by 3M model #DBR-2, designated for below grade waterproof irrigation wire splices.

B. Valve access boxes:

1. Boxes and Valve Box Covers Tapered rib reinforced enclosure of rigid plastic material comprised of fibrous components chemically inert and unaffected by moisture, ultraviolet light corrosion and temperature changes.
2. Base 12" deep x 18" long x 12" wide standard valve box.
3. Lid, green in color with lock.
4. Valve Box shall be manufactured by NDS, Carson, or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Layout and stake the location of each pipe run and all sprinkler heads and sprinkler valves. Obtain Owner or Owner's representative acceptance of layout prior to excavating.

3.3 INSTALLATION

A. Excavating and backfilling:

1. Excavation shall include all materials encountered, except materials that cannot be excavated by normal mechanical means.
    a. Rock excavation: Submit a unit cost per foot of trench for rock excavation. Include in price additional backfill materials required to replace excavated rock.

2. Excavate trenches for sufficient depth and width to permit proper handling and installation of pipe and fittings.
    a. All PVC (over 2" diameter) piping is to be trenched.
    b. Areas where the trenching method is to be used, all sod shall be removed & reinstalled within 24 hours, if applicable.

3. The pulling method may be used on all laterals; the pipe "plow" shall be a vibratory type. Starting and finishing holes for pipe pulling shall not exceed a 1'-0" by 3'-0" opening.
4. Excavate to depths required to provide 2" depth of earth fill or sand bedding for piping when rock or other unsuitable bearing material is encountered.
5. Fill to match adjacent grade elevation with approved earth fill material. Place and compact fill in layers not greater than 6" depth to achieve 85% of maximum dry ASTM D698 standard proctor method.
    a. Provide approved earth fill or sand to a point 4" above the top of pipe.
    b. Fill to within 6" of final grade with approved excavated or borrowed fill materials free of lumps or rocks larger than 3" in any direction.
    c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.

6. Except as indicated: install irrigation mains with a minimum cover of 16" & a maximum cover of 24" based on finished grades. Install irrigation laterals with a minimum cover of 12" based on finished grades.
7. Excavate trenches and install piping and fill during the same working day. Do not leave open trenches or partially filled trenches open overnight.
8. Contractors shall not crown and backfill on the trench area with the thought that it will eventually settle; this will not be acceptable as a finished job. The Contractor will guarantee all trenches to be free from heaving or settling more than 1/2". Should it

become necessary to adjust the grade, the Contractor shall remove the sod, regrade the trench and replace the sod. This no settlement clause shall extend over the entire period of the

9. Contractors guarantee of the job. Any bad areas shall be completely resodded by the Contractor, at his expense, the following Spring and the sod shall contain grasses similar to existing grass in the area to be corrected. Trenches shall be finish graded prior to walk through of system with Owner or Owner's representative. Contractor shall restore disturbed areas to original condition.

B. Plastic Pipe

1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
2. Saw cut plastic pipe. Use a square-in-sawing vice, to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
3. Make plastic to plastic joints with solvent weld joints or slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Gasketed pipe shall be lubricated with approved lubricant only. (Non-petroleum based). Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
4. Make solvent weld joints as follows:
   a. Thoroughly clean the mating pipe and fitting with a clean dry cloth. Clean fittings with Oatey PVC-ABS plastic pipe fitting cleaner or approved other.
   b. Apply a uniform coat of solvent/cement to the outside of pipe with non- synthetic bristle brush.
   c. Apply solvent/cement to fittings in similar manner.
   d. Re-apply light coat of solvent/cement to pipe and quickly insert it into fitting.
   e. Give pipe or fitting a quarter turn to ensure even distribution of solvent/cement and verify pipe is inserted to full depth of fitting socket.
   f. Hold in position for 30 seconds.
   g. Wipe off excess solvent/cement that appears at outer shoulder of fittings.
5. Do not use excessive amounts of solvent/cement. An excess amount of solvent/cement will cause a burr or obstruction to form of the inside of the pipe.
6. Allow joints to set at least 24 hours before pressure is applied to the system.
7. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.

C. Sprinklers, fittings, valves, and accessories:

1. Install fittings, valves, sprinklers heads, risers, and accessories in accordance with manufacturer's instructions, except as otherwise indicated.
2. Set sprinkler heads perpendicular to finished grades, except as otherwise indicated.
3. Obtain Owner or Owner's representative review and acceptance of height for proposed sprinkler heads and valves prior to installation.
4. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distances indicated.

5. Install field sprinklers with Lasco Swing Joint #G132-212 Assembly as indicated. If not shown differently in detail drawings.
6. Install quick-coupling valves with Lasco Snaplok Assembly #G33S-212 as indicated. If not shown differently in detail drawings.
7. Install all control valves in valve access boxes as indicated.
8. Install all gate valves in a 10” round valve box.
9. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.
10. Seal threaded connections on pressure side of control valves with teflon tape or approved plastic joint type compound.

D. Flushing, testing and adjustment:

1. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
2. Perform system testing upon completion of each section. Make necessary repairs and re-test repaired section as required.
3. The Contractor shall adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways and buildings as much as possible. If it is determined that the irrigation adjustments will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to final acceptance at direction of Owner or Owner's representative at no additional expense. Adjust sprinklers after installation for proper and adequate distribution of the water coverage pattern. Adjust for the proper arc coverage. Use matched precipitation rate nozzles as per accepted industry standards. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling as required.
4. Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.
5. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate turf requirements and weather conditions.

3.4 DISPOSAL OF WASTE MATERIAL

A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris. Maintain disposal route clear, clean, and free of debris.

3.5 ACCEPTANCE

A. The Contractor shall arrange for presence of Owner or Owner's representative 72 hours in advance of anticipated walk-through.

B. Entire system shall be completely installed and operational prior to the scheduling of the walk-through.

C. The Contractor shall operate each zone in its entirety for the Owner or Owner's representative at time of walk-through and will additionally open all valve boxes for observation by Owner or Owner's representative.

D. Owner or Owner's representative shall generate a "punch" list indicating all items to be corrected prior to scheduling of final walk-through.

E. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate or inappropriate, without bringing it to the attention of the Owner or Owner's representative.

F. The Contractor shall arrange for the presence of Owner or Owner's representative 72 hours in advance of anticipated walk-through.

G. The Contractor shall show evidence the Owner or Owner's representative has received all accessories, charts, record drawings, and equipment as required before final acceptance will be scheduled.

H. The Contractor shall operate each zone, indicated on "punch" list, in its entirety for the Owner or Owner's representative at time of walk-through to insure correction of all items on "punch" list.

I. Any items deemed not acceptable by the Owner or Owner’s representative shall be reworked to the complete satisfaction of the Owner.

J. If after request by the Contractor to the Owner or Owner's representative for a final walk-through of the irrigation system, the Owner or Owner's representative finds items during the final walk-through which have not been properly adjusted, reworked, or replaced as indicated on the "punch" list generated from the preliminary walk-through, the Contractor shall be back charged for all Payment and /or retainage to Contractor, in the amount equal to the additional time and expenses required by Owner or Owner's representative to conduct and document any further walk-throughs as deemed necessary by Owner or Owner's representative to insure compliance with contract drawings and specifications.

3.6 CLEAN UP

A. Clean-up shall be a continuous operation throughout the duration on the work. Materials brought into the area shall be neatly stockpiled upon completion of each day. Contractor shall be responsible for disposing of, off site, at no additional expense, any trash or debris generated by the installation of the work. Debris shall not be allowed to accumulate and will be removed from the project area at least once weekly or more often if necessary in order to maintain a safe, neat and attractive appearance in the project area. All dirt, mud or debris shall be removed from sidewalks and paved areas at the end of each work day and sidewalks shall be left broom cleaned.

3.7 WINTERIZATION

A. Contractor shall include in his bid proposal and shall be responsible for winterizing the complete system at the conclusion of the irrigation season (in which the system received final acceptance) within 12 days upon reasonable notification by the Owner. The system shall be voided of water using compressed air or similar method which is approved by the various system components manufacturers' and Owner or Owner's representative. Contractor shall re-open, operate and adjust system malfunctions accordingly.

END OF SECTION 328423

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Sodding.
3. Hydroseeding.

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Division 33 Section "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

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

H. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 REFERENCES

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

1. American Society for Testing and Materials (ASTM)
   C 136 Sieve Analysis of Fine and Course Aggregates
   D 422 Particle-Size Analysis of Soils
   E 11 Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

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

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod and native seed mix. Include identification of source and name and telephone number of suppliers.

C. Qualification Data: For qualified landscape Installer.

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

E. Material Test Reports: For standardized ASTM D 5268 topsoil existing native surface topsoil existing in-place surface soil and imported or manufactured topsoil.

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A North Carolina Board of Landscape Contractors certified Landscape Contractor whose work has resulted in successful turn establishment. The Contractor’s company and Field Supervisor must be Board certified.

1. Experience: Five years minimum experience in turf installation.
    a. Installer to show a minimum of 5 project examples and owner point of contacts for project similar in scope and quality completed in the last 5 years.
2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
3. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
4. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.
    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

D. Preinstallation Conference: Conduct conference at Project site.

E. Provide appropriate treatment for fire ant infestation on plant material prior to shipment from nursery as required by the North Carolina Department of Agricultural and Consumer Services Guidelines.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Seed: Deliver seed in original, sealed, labeled, and undamaged containers

D. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting Seeding: Feb 1 - Apr 15.
2. Fall Planting Seeding: Aug 25 – Nov 1.
3. Sod Planting May 1 to Oct 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.9 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: **Certified**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Sod Species: **Bermuda 419 or alternate**

2.2 GRASS SEED

A. Provide fresh, clean, new crop lawn seed mixture. Furnish to Owner dealers guaranteed statement of composition of mixture and percentage of purity and germination of each variety.

B. Seed Mixture: Provide seed of grass species and varieties, proportions by weight and minimum percentages of purity, germination, and maximum percentage of weed seed. Reference Plans for Seed mixture. Below is the general seed recommendation by pound per acres. Substitution mixes may be submitted for review and approval.

March 1 - August 31		**September 1 - February 28**	
50#	Tall Fescue	50#	Tall Fescue
10#	Centipede	10#	Centipede
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)

2.3 ORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through [1-inch] sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.5 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 to 4 percent nitrogen and 10 to 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.6 PLANTING SOILS

A. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth. Mix soil amendments as necessary per Landscaper recommendations.

2.7 MULCHES

A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

C. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.8 PESTICIDES

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

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.9 FIRE ANT TREATMENT / PREVENTION

A. Bait Applications of AMDRO per acre or approved equal.

B. Drench Applications of Orthene on each active hill or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting

performance.

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

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches to 8 inches Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
b. Mix lime with dry soil before mixing fertilizer.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least 6 inches to 8 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches to 6 inches of soil. Till soil to a homogeneous mixture of fine texture.

    a. Apply fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate indicated on plans.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 per erosion control plans.

E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of [2 tons/acre] to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch peat mulch planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre] dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of [1000 lb/acre].

3.6 SODDING

A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Landscape Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs [**or steel staples**] spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

D. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

3.7 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
3. The Contractor is responsible for watering all seeded and sodded areas for a period of 90 days. Method of water to be determined by the contractor at their expense.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow zoyisa to a height to 1.4 inches.
2. Mow bluegrass and other cool season grasses to a height of 1-1/2 to 2-1/2 inches.
3. Native Grasses:
    a. Initiate mowing of turf grass areas when grass has attained height of 3 feet and roots are firmly established. Maintain turf grass height at 3 feet. Mow in fall after grass turns brown (becomes dormant) and in spring for early season weed control (once weeds/grasses get to about 18 inches high – can be cut back to 6 – 8 inches). Mow native grass areas no more than 3 times per year.

D. If lawn or grass is established in the fall and maintenance is required to continue into the spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the following rates.
1. Lime: 100 lb. / 1000 sq. ft.
2. Fertilizer: 20 lb. / 1000 sq. ft.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

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

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.11 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in “Turf Maintenance” Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 90 days from date of planting completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 90 days from date of planting completion.

END OF SECTION 329200

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Grout.
4. Flowable fill.
5. Piping system common requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.4 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

2.3 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.4 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft..
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved by the Engineer.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

E. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Cure placed grout.

END OF SECTION 330500

SECTION 331100 – WATER DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide water distribution system as shown on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
2. Section 02221 - Trenching, Backfilling for Utilities.
3. Section 02516 - Disinfection of Potable Water Lines.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. All materials in this Section are to be 100% manufactured in the United States.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01640.

B. Shipment of pipe: Protect pipe with tarp or other means during shipment to prevent truck exhaust from damaging pipe.

C. Storage of PVC pipe:

1. Store in unit packages as received from manufacturer until just prior to use.
2. Stack units in such manner as to prevent deformation to pipe barrel and bells.

3. Protect from direct sunlight by covering with opaque material if storage period will exceed six weeks.

D. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

PART 2 - PRODUCTS

2.1 GENERAL

A. Use any pipe material and associated fittings as specified herein, except where use of a particular material is indicated on the plans, or specified herein.

2.2 PIPE AND FITTINGS

A. General:

1. Pipe sizes 3" and larger: Use ductile iron or plastic pipes unless otherwise indicated. No asbestos cement pipe allowed.
2. Pipe less than 3" size: Use plastic pipe.
3. Any pipe, solder, or flux used shall be lead free (lead free is defined as less than 0.2% lead in solder or flux and less than 8.0% lead in pipes and fittings).
4. Gaskets are to be factory-installed and integral with the pipe.
5. All pipe 4" and larger shall be National Sanitary Foundation (NSF) approved and shall be third party certified as meeting the specifications of ANSI/NSF Standard 61.
6. All materials and products that contact potable water shall be third party certified as meeting the specifications of ANSI/NSF Standard 61.
7. All chemical or products added to the public water supply must be third party certified as meeting the specifications of ANSI/NSF Standard 60.
8. For valves cast all markings integral on the valve body with the size of valve, year of manufacture and the class working pressure.
    a. Certifications to rate a 150B valve body to a Class 250 valve will not be acceptable.
9. For valves spray coat all interior wetted ferrous surfaces with two-component epoxy applied to a nominal thickness of 3 to 4 mils.
    a. Coating material to be AWWA and U.S. Food and Drug Administration approved for use with potable water.
10. Exterior Coatings: For ductile iron pipe
    a. For buried service provide bituminous coating.
    b. For exposed locations comply with Section 09900.

B. Pipe:

1. Ductile iron pipe (DIP):

    a. Comply with ANSI/AWWA C150/A21.50 or AWWA C151/A21.51, latest revision.
    b. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark,

country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

c. Wall thickness in accordance with Table 50.5 of ANSI/AWWA C150/A21.50, depth of cover indicated and Type 3 bedding conditions, minimum Pressure Class as follows: 4" - 12" Pressure Class 350

d. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.

2. Plastic pipe (PVC):

a. General:

1) Marked with National Sanitation Foundation approval; date pipe was produced, type, and size at 18" intervals.

2) Minimum wall thickness for 8” diameter pipe is 0.410 inches.

3) Gaskets to comply with ASTM F 477.

a) Natural rubber gaskets are not acceptable.

b. 4" - 12": Comply with ANSI/AWWA C900, Table 2, Pressure Class 150 (DR18).

c. 14" and above: Comply with ANSI/AWWA C905, Table 2, Pressure Class 165 (DR 25).

d. Plastic pipe 3" and smaller: Comply with ASTM D 2241 for PVC 1120, SDR 21. 3" and below.

e. Color of pipe to be blue.

C. Joints:

1. Ductile iron pipe:

a. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.

b. Use gaskets and lubricant complying with ANSI/AWWA C111/A21.11. Natural rubber gaskets are not acceptable.

c. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints.

1) NSF approved.

d. Exposed pipe:

1) Class 53 minimum.

2) Use flanged joints complying with ANSI/AWWA C115/A21.11, latest revision and:

a) Provide solid type flanges with country where cast stamped or cast into the flange.

b) Use full face, red rubber, factory cut, 1/16" thick for pipe up to 10" diameter and 1/8" thick for larger sizes.

c) Bolts and nuts shall be standard carbon steel machine bolts, hex head complying with ANSI A21.11/AWWA C111.

2. Plastic pipe:

    a. Use integral bell or coupling type with elastomeric gaskets.
    b. Integral bells to comply with ASTM D2672.
    c. Couplings to comply with ANSI/AWWA C900.
    d. Gaskets to comply with ASTM F477.

        1) Natural rubber gaskets are not acceptable.

    e. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints.

        1) NSF approved.

D. Fittings and specials:

1. Ductile iron pipe:

    a. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
    b. Clearly cast the manufacturer's mark, country where cast, year in which the fitting was produced, and the letters "DI" or "Ductile" on the fitting."
    c. Compact fittings for piping 3" - 16" may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.
    d. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
    e. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
    f. The maximum phosphorous level in the casting will be 0.08%.
    g. The fitting surface finish will conform to MSS SP-112 Quality Standard for Evaluation of Cast Surface Finishes.
    h. The manufacturer shall be ISO 9000 certified.
    i. Markings: Each fitting shall have the following markings cast integrally to the fitting:

        1) Manufacturer's Name or Logo
        2) "MJ"
        3) Country of origin
        4) Manufacturer's Foundry Mark
        5) AWWA C-153 or C110
        6) Pressure Rating
        7) Nominal Diameter (each leg)
        8) "DI" or "Ductile"
        9) No. of Degrees (bends)

2. Plastic pipe 4" and larger:

a. Use 250 psi pressure rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10.
b. Compact fittings for piping 3" - 16" may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.
c. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
d. Provide adapter glands, gaskets, etc. as required to accommodate any differences in pipe and fitting dimensions.
e. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
f. The maximum phosphorous level in the casting will be 0.08%.
g. The fitting surface finish will conform to MSS SP-112 Quality Standard for Evaluation of Cast Surface Finishes.
h. The manufacturer shall be ISO 9000 certified.
i. Markings: Each fitting shall have the following markings cast integrally to the fitting:

1) Manufacturer's Name or Logo
2) "MJ"
3) Country of origin
4) Manufacturer's Foundry Mark
5) AWWA C-153 or C110
6) Pressure Rating
7) Nominal Diameter (each leg)
8) "DI" or "Ductile"
9) No. of Degrees (bends)

3. Plastic pipe 3" and smaller: Use PVC fittings, 160 psi at 73ºF pressure rating, joint design to conform to pipe joints.

E. Couplings:

1. Provide couplings where needed to make piping connections and where located on the plans.
2. Provide mechanical joint ductile iron sleeve, full length, minimum 12".
3. Provide cutting-in sleeve where installing fittings in an existing line.

a. Provide ductile iron with mechanical joint.

4. Provide restrained joint couplings where restrained joints are indicated on the plans.

F. Restrained joint pipe and fittings:

1. Provide restrained joint pipe and fittings on all piping at each fitting, including valve and fire hydrant connections, and on the pipe joints to a distance of 18' each side of the fitting for 12" piping and smaller and to a distance of 36' each side of the fitting for piping over 12".

a. Provide one of the following:

1) Snap-Lok by Griffin Pipe.
2) American Cast Iron Pipe Company.
   a) Flex-Ring (4" - 36").
   b) Lok-Ring (42" - 64").
3) TR-Flex by U. S. Pipe.
4) Super-Lock by Clow (4" - 30").
5) Fast Grip Gasket by American Cast Iron Pipe Company.
6) Field Lok by U.S. Pipe.

b. Ductile iron pipe:

1) Provide retainer glands for use with mechanical joint pipe and fittings.
2) Provide wedge type.
3) Provide ductile iron gland conforming to ASTM A 536-80. Provide split gland where standard gland cannot be installed.
4) Provide ductile iron set screws, heat-treated to a minimum hardness of 370 BHN with twist-off nuts and permanent standard hex head remaining.
5) Provide for the following rated pressure with minimum 2 to 1 safety factor; 3" - 16" 350 psi, 18" - 48" 250 psi.
6) Provide tee-head bolts conforming to ANSI/AWWA C111/A21.11 latest revision.
7) Provide "MEGALUG" series 1100 or series 1200 as manufactured by EBAA Iron, Inc., of Eastland, Texas, or approved equal.

c. Provide restraint for C900 PVC by mechanical means separate from the mechanical joint gasket sealing gland.

1) Provide wide, supportive contact around full pipe circumference as follows:

Size	**Restraint Width**
4", 6"	1-1/2"
8", 10", 12"	1-3/4"

2) Provide means of restraint by machined serrations on inside surface of restraint device designed to provide circumferential loading over the entire restrainer.
   a) Design to be such that restraint increases with increased in-line pressure.
   b) Provide a minimum of 8 serrations per inch of restraint width.
3) Restraint device to be pressure rated at 350 psi, or equal to the pipe on which it is used and capable of withstanding test pressures of 2 times pressured rating.
4) Fusion applied epoxy coating finish per AWWA C-213.
5) Provide series 1600 as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved equal.

d. Provide restraint for C905 PVC pipe 14" and larger by mechanical means separate from the mechanical joint sealing gland.

1) Restraint device to be a two-piece configuration with plurality of individually actuating gripping services.
2) Restraint device body to be manufactured from ductile iron conforming with ASTM A536.
3) Comply with AWWA C111, ANSI 21.11.
4) Pressure rating to match PVC pipe on which it is used with capability to withstand test pressure of 2 times rated pressure.
5) Fusion applied epoxy coating finish per AWWA C-213.
6) Provide series 2800 as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved equal.

e. Provide restraint for PVC pipe (PVC 1120, SDR 21) 12" and smaller by split serrated ring.

1) Restraint device to be a two-piece configuration with plurality of individually actuating gripping services.
2) Restraint device body to be manufactured from ductile iron conforming with ASTM A536.
3) Pressure rating to match PVC pipe on which it is used with capability to withstand test pressure of 2 times rated pressure.
4) Fusion applied epoxy coating finish per AWWA C-213.
5) Provide series 6500 as manufactured by EBAA Iron, Inc., of Eastland, Texas, or approved equal.

f. Provide restraint between PVC and mechanical joint ductile iron fitting and/or valves where indicated on the plans.

1) Provide device consisting of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C111/A21.11.
2) The device will have a working pressure rating equal to the pipe on which it is used and include a minimum design pressure safety factor of 2:1.
3) Gland body, wedges and wedge actuating components will be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
4) An identification number consisting of year, day, plant and shift will be cast into each gland body.
5) Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
6) Provide series 2000 PV by EBBA Iron, Inc. or equal.

G. Tee head bolts: Provide Cor-Ten or engineer approved equal steel tee head bolts for use on mechanical joints complying with ASTM A242.

H. Plugs or caps:

1. Provide at all pipe ends and unused branches of fittings.
2. All plugs and caps shall be tapped 2" and provided with 2" plug.
3. Plugs and caps to be restrained joint.

I. Polyethylene encasement:

1. Provide polyethylene encasement of pipe and fittings where indicated on the plans.
2. Minimum nominal thickness of 8 mils. ±10%.
3. Conform to AWWA C105.

2.3 COPPER TRACER WIRE

A. Provide a continuous 12 gauge blue insulated copper tracer wire when PVC or polyethylene pipe is used.

B. Approved for direct burial by the manufacturer.

C. Locate tracer wire a minimum of 6" above top of water main.

D. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves and meters.

E. Connect to the water line with duct tape at every bell connection or every 20'-0" to ensure that the wire is directly over the top of the pipe.

F. Place in the trench with all service lines.

G. Splice at each service lateral and tee connection with an approved copper compression lug.

H. Test all tracer wire for conductivity in accordance with Part 3.

2.4 VALVES

A. General:

1. 1-1/2" and smaller: Use gate valves or ball valves.
2. 2" through 12": Use gate valves.
3. Open by turning counterclockwise.
4. End connections as required for the piping in which they are installed.
5. 2" metal operating nut with arrow indicating direction of opening.
6. Use valves designed for a working pressure of not less than 200 psi.
7. Provide stem extensions on all valves where the top of the operator nut is located greater than 36" below the top of the valve box.
8. Fully coat all internal ferrous metal surfaces with two-part thermosetting epoxy.
9. Design for external stem failure when excessive closing torque is applied with no failure of the pressure retaining parts.
10. Provide double disc gate valves with bevel gears, grease case, and other necessary appurtenances for horizontal installation.

B. Gate valves 1-1/2" and smaller:

1. Use all bronze ball valves, 1/4 turn with stop, 2" square nut operator.
2. Provide Ford Model B11-QT67 or equal.

C. Gate valves 2" through 12":

1. Use resilient seated wedge valves complying with ANSI/AWWA C509.
2. Provide integrally cast bronze stem nut on resilient seated wedge valves.
3. Suitable for working pressure of not less than 250 psi.
4. Design for external stem failure outside of the valve body or bonnet when excessive closing torque is applied with no failure of the pressure retaining parts per AWWA Section 3.2.

    a. Factory test with no leakage from either side of the disc.
    b. Test shell to 500 psig.

5. Provide certified to NSF 61.
6. Resilient wedge valves:

    a. Completely encapsulate resilient iron wedge by an elastomer, without thin spots or voids.
    b. Provide polymer wedge guide bearing caps bearing surface between the encapsulated wedge and the interior epoxy coating, lowering operation torque and extending service life of the valve.
    c. The manufacturing plant to have ISO 9001 certification.

7. Acceptable Manufacturer: Mueller.

D. Valve operator:

1. Provide one T-handle operator for each ten buried valves with nut operator.
2. Provide one stainless steel T-handle operator for each four buried valves with "T" head.

2.5 VALVE BOXES

A. Provide at each buried valve.

B. Cast iron extension type, suitable for minimum cover of 3'-6" over the pipe.

C. Minimum inside diameter at the top of 5", minimum riser wall thickness 1/4" and thickness at the top of 11/16".

D. Have the word "WATER", "SEWER", "SLUDGE", etc., as applicable, cast into the cover.

E. Provide Tyler Series 6850.

F. Where depth requires more than a two-piece box use adjustable cast iron extensions.

G. Coat box and cover with two (2) shop coats of bitumastic paint.

2.6 VALVE BOX PROTECTION RING

A. Provide at each valve box a precast concrete protection ring.

B. Provide two rings of No. 3 reinforcing steel, one 14" in diameter, and one 23" in diameter.

C. Inside dimensions to be 9-1/4".

D. Outside diameter to be 27".

E. Provide 5" thickness at interior with a continuous slope to 2" thickness at the outside.

F. Minimum weight of 110 lbs.

2.7 SERVICE SADDLE

A. Provide of the following materials:

Body	Type 304 Stainless Steel
Bales and Strips	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel

B. Provide plastic lubricating washers.

C. Coat all stainless steel fasteners to prevent galling.

D. Provide for maximum working pressure of 150 psi.

E. Provide Romac Model 306 for up to 10” and Model 305 for 10” to 24” or engineer approved equal.

F. Connect to pipeline using a 6" stainless steel nipple.

1. Do not use a threaded PVC connection.

2.8 AIR RELEASE VALVES

A. Provide air release valves where indicated on the drawings.

B. Provide cast iron body with stainless steel internal trim and float.

C. Provide stainless steel seat with BUNA-N rubber valve.

D. Provide 1" NPT inlet.

E. Provide Crispin Model PL10 or engineer approved equal.

F. Provide a heavy-duty cast iron meter box to house valve.

1. USF 7634 heavy duty meter box with FM cover or equal.
2. Coat with two (2) shop coats of bitumastic paint.

2.9 MISCELLANEOUS PARTS AND ACCESSORIES

A. Use standard commercial grade suitable for the type of installation or system involved, and conforming to the applicable standards and specifications of the AWWA.

PART 3 - EXECUTION

3.1 HANDLING

A. Handle pipe accessories so as to ensure delivery to the trench in sound, undamaged condition:

1. Carry pipe into position. Do not drag.
2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.
3. Use care not to injure pipe linings.
4. Do not damage pipe with chokers or lifting equipment.

B. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other method approved by the Engineer.

C. Before installation, inspect each piece of pipe and each fitting for defects.

1. Material found to be defective before or after laying: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.

D. Gaskets: Store in a cool dark place until just prior to time of installation.

3.2 PIPE CUTTING

A. Cut pipe neatly and without damage to the pipe.

B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Engineer, cut pipe with mechanical cutter only.

1. Use wheel cutters when practicable.
2. Cut plastic pipe square, remove all burrs, and grind bevel on end.

3.3 LOCATING

A. Water mains shall be laid at least 10'-0" edge-to-edge horizontally distanced from any existing or proposed sewer pipes.

B. Should a 10'-0" separation not be practical, then the water main may be located closer with North Carolina Department of Environmental Quality (DEQ) approval provided:

1. It is laid in a separate trench.
2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.
3. In either of the above cases, crown elevation of the sewer shall be at least 18" below invert elevation of water line.

C. Where water lines cross over sewers, maintain 18" vertical separation between the outside of the sewer and the outside of the water line.

D. Where water lines cross under sewers, each line shall be cast iron or ductile iron.

1. A full length of water line shall be located over an existing sewer so that joints of each line will be as far from each other as possible.
2. Where a new water main crosses a new sewer line, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each line will be as far as possible from the point of crossing and each other.

E. No water pipe shall pass through or come in contact with any part of a sewer manhole.

F. Water lines shall not be laid within 25'-0" horizontally from any portion of a wastewater tile or spray field.

G. Water lines shall be located outside all contaminated areas, unless using pipe materials that will protect the water supply.

H. No flushing device or drain directly connected to any type of sewer is allowed.

I. No cross connections between water lines and any pipes, valves, tanks or pumps that are not part of the potable water system are allowed.

J. Water lines may come in contact with storm sewers or catch basins if there are no other practical alternatives provided that ductile iron is used and no joints of the water line are within the storm sewer or catch basin, and, provided that the joints are located as far as possible from the storm sewer or catch basin.

K. Structures containing valves, blowoffs, meters, air release valves, etc., shall not be connected directly to any storm drainage or sewer system.

3.4 EXCAVATION AND BACKFILLING

A. Comply with pertinent provisions of Section 02221 and Section 02615 of these Specifications.

B. For PE Pipe, comply with manufacturer's recommendations.

3.5 ALIGNMENT OF PIPE

A. Pipelines intended to be straight shall be so laid.

B. Where vertical or horizontal alignment requires deflection from straight line or grade, such deflection shall not exceed maximum deflection recommended by the pipe manufacturer.

C. If alignment requires deflection exceeding recommended limits, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the allowable limits.

3.6 PLACING AND LAYING

A. General:

1. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Engineer.
2. Do not dump or drop any of the materials of this Section into the trench.
3. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
4. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
5. Take up and relay pipe that has the grade or joint disturbed after laying.
6. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
7. Securely close open ends of pipe, fittings, and valves when work is not in progress.
8. Where any part of coating or lining is damaged, repair to the approval of the Engineer and at no additional cost to the Owner.
9. Structures containing valves, blowoffs, meters, air release valves, etc., shall not be connected to any storm drain or sewer system.

B. Ductile iron pipe:

1. Mechanical, push on and flanged joints, install in accordance with ANSI/AWWA C600.
2. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations.

C. Plastic pipe:

1. Clean gasket, bell or coupling interior, especially groove area.
2. Lubricate and insert gasket as recommended by manufacturer.
3. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.

4. Bell pipe using manufacturer's approved leverage bar.
   a. Do not use machinery to push pipe "home".
5. Push pipe "home" until reference mark is at proper location and clearly visible.
6. Follow all pipe manufacturers installation instructions.

D. Flanged joints:

1. Provide true face flanges, field clean and fit with one full face gasket and make bolts up finger tight.
2. Use torque wrench to alternately tighten bolts 180 degrees apart until full gasket flow and seal are secured.
3. Bias cut or unusual refacing of any flange will not be acceptable.

E. Restrained joints:

1. Install in accordance with manufacturer's instructions.
2. Tighten set screws to the manufacturer's rated torque using a torque wrench. If twist-off nuts are provided, tighten screws until nut breaks loose.

F. Polyethylene encasement: Comply with AWWA C105.

3.7 TRACER WIRE TESTING

A. General:

1. Utilize an approved magnetic locating device, M Scope or Equal.
2. Connect a cable conductively from the transmitter to a metal ground rod and to the tracer wire.
3. Locate the line following the instructions of the magnetic locating device.
4. If interference is encountered form adjacent utilities or if the depth of bury or line length interferes with the signal, install a dummy valve box with access to the tracer wire at no additional cost to the owner.
5. Where there is a break in the tracer wire, repair with 3M DBY or ILSCO #IK-8 repair kit and wrap with poly wrap for cathodic protection.

B. Creek crossing and wetland areas:

1. Send a prescribed frequency with a shore line base signal ejector between 25 and 1024 HZ down a metal medium and read by a receiver.
2. Select a frequency based on the depth and the amount of linear feet of the line.
3. If the tracer wire has a break, reinstall the cable and repeat the conductivity test at no additional cost to the owner.

C. Notify in advance and conduct all testing in the presence of the Engineer.

3.8 SETTING VALVES AND VALVE BOXES

A. General:

1. Center valve boxes on the valves, setting plumb.
2. Tamp earth fill around each valve box to a distance of 4'-0" on all sides, or to the undisturbed trench face if less than 4'-0".
3. Install shaft extensions plumb without any binding.
4. Fully open and close each valve to assure that all parts are in working condition.
5. Place valve box protection ring around top of valve box as indicated on the plans.

    a. Install ring level with top 1" above finished grade.
    b. Top of ring to be level with or no more than 1" above the top of the valve box.

3.9 HYDROSTATIC TESTING

A. General:

1. Pressure and leakage testing must be conducted in accordance with AWWA Standards C600.
2. Clean and flush line of air, dirt and foreign material.
3. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.
4. Test pump, pipe connection, pressure gauges, measuring devices and all other necessary appurtenances to conduct tests are to be provided by the Contractor.
5. Install brass corporation cocks at all high points that do not have permanent air vents. Corporation cocks are to be left in place and all costs for providing such cocks are to be borne by the Contractor.
6. Conduct tests on each line or valved section of line.
7. Test pressures to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
8. Do not test pipe at pressures exceeding manufacturer's recommendations.
9. The Contractor must provide documentation of the pressure and leakage tests. Documentation must include length of lines, diameter of pipe(s), amount of water required to fill line after test was performed, and amount of allowable leakage.
10. The witness to the hydrostatic testing is to be someone other than the Contractor or the utility installing the lines.

B. Pressure tests:

1. After the pipe is laid, the joints completed, and the trench backfilled, subject the newly laid piping and valved sections of the piping to the test pressure specified in Part A above.
2. Open and close each valve within the section being tested several times during the test period.
3. Conduct the pressure test using a 4" diameter glycerin filled gauge with a snubber attached prior to the gauge to remove pulsations.

a. Obtain prior approval of the testing gauge approved by the Engineer prior to its use.
b. Provide a range of no greater than twice the test pressure and not less than 50% greater than the test pressure.
c. Calibrate with cal sticker on gauge face or provide appropriate supporting paperwork.

4. Replace or remake joints showing leakage.

a. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings and valves. Replace with sound material and repeat the test until results are satisfactory.
b. Make repair and replacement without additional cost to the Owner.

C. Leakage test:

1. Conduct leakage test after the pressure test has been completed satisfactorily.
2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to the test pressure specified in Part A above.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

a. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula(s):

L = S x D x /148,000; where

L = allowable leakage in gallons per hour;
S = length of pipe tested in feet;
D = nominal diameter of pipe in inches; and
P = average test pressure psi gauge.

b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size will be allowed.
1) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
2) Repair all visible leaks regardless of test results.

3.10 STERILIZATION

A. Sterilize in accordance with Section 02516 - Disinfection of Potable Water Lines.

3.11 DECHLORINATION OF CHLORINATED STERILIZATION WATER

A. Dechlorinate in accordance with Section 02516 – Disinfection of Potable Water Lines.

3.12 MEASUREMENT AND PAYMENT

A. All work under this Section will be measured and paid for as follows:

B. Pipe will be paid for at the unit prices per linear foot as stated in the Bid Form and shall include cost of excavation, backfilling, copper tracer wire, cleanup, testing, sterilizing, dechlorinating, etc. Measurement will be from center to center of fittings; no deduction will be made for the space occupied by valves or fittings.

C. Ductile iron fittings will be paid at the unit price per each as stated on the bid form. The unit price will include all cost of fitting, accessories, retrained joint accessories, excavation, testing, etc., for a complete installation.

D. Fittings other than ductile iron: No measurement will be made and cost for these fittings shall be included in the price bid per linear foot of the pipe with which they are used. No extra payment will be made for these fittings.

E. Valves will be paid for at the price for "each" as stated in the Bid Form. This payment shall include valve, stem extensions, valve box, valve box protection ring, and installation.

F. Restrained joint pipe will be paid for at the unit price per linear foot as stated in the Bid Form and include all items described in "B" above and the cost of all restrained joint accessories.

G. Hydrants will be paid for at the unit price for "each" as stated in the Bid Form. This payment shall include hydrant, reflector and offset fitting. Piping and valve to the hydrant will be paid for under paragraphs B. and E. above.

H. Tie-ins to existing lines: Where connection to an existing main is made by removing an existing plug, no payment will be made for this work.

I. Air release valves: Payment will be made at the cost per each as stated in the Bid Form. This payment will include air release valve, corporation and curb stops, piping from main to valve and box.

END OF SECTION 331100

SECTION 334100 - 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. This Section includes gravity-flow, nonpressure storm drainage associated with the stormwater management facilities, with the following components:

1. Special fittings for expansion and deflection.
2. Precast concrete and Cast-in-place concrete structures.

B. Related Sections include the following:

1. Division 33 Section "Subdrainage" for installation of subdrainage piping of dam embankment.

1.3 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

B. Pressure-Piping Pressure Rating: At least equal to system operating pressure but not less than 10 psi rated water tight joints.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.

B. Shop Drawings: For the following:

1. Stormwater Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

C. Field quality-control test reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle structures according to manufacturer's written rigging instructions.

1.6 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 Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 DUCTILE-IRON CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A 716, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.4 PVC PIPE AND FITTINGS

A. PVC Pipe and Fittings: ASTM D 1785, Schedule 80 pipe, with plain ends for solvent-cemented joints with ASTM D 2467, Schedule 80, socket-type fittings.

2.5 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with modified bell-and-spigot ends and confined O-ring gasketed joints with ASTM C 443, rubber gaskets. The pipe joints shall be Type R-4. The pipe shall be manufactured with no lift holes.
   1. Class III, Wall B.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.7 STORMWATER STRUCTURES

A. Cast-in-Place Concrete, Stormwater Structures: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 structural loading; of depth, shape, dimensions, and appurtenances indicated.

   1. Anti-Flotation Block: Can either be cast-in-place or precast

      a. If cast-in-place prior to constructing, the contractor shall insure the weight of the entire riser structures meets minimum specifications provided on Drawings, and shall submit shop drawings to the Engineer for review denoting the following:

         1) Steel reinforcement
         2) Connection mechanism to join anti-flotation block with riser section.

      b. If precast, the anti-flotation block shall be included as part of the precast riser shop drawing submittals to the Engineer for review. It shall meet minimum specifications provided on Drawings.

   2. Concrete Collar: Shall connect to riser structure and anti-flotation block to form a watertight connection between outlet barrel and riser structure. It shall meet minimum specifications provided on Drawings.

B. Steps: Provide steps as shown on the Drawings in manholes, risers, transition cones, and transition top sections in accordance with NCDOT STD 840.66. Steps shall be spaced at 16” O.C.

C. Emergency drawdown pipe shall be a M&H style 1820 eccentric valve or approved equal. This valve is in accordance with AWWA C-540 Sec 5.5, and shall be operable from top of outlet structure via a handwheel. Refer to valve specifications at the end of this section.

D. Trash rack: Prior to ordering, the contractor shall submit trash rack shop drawings to the Engineer for review. A minimum 2 foot x 3 foot access hatch opening is required and shall be centered over access steps. Trash rack shall meet minimum specifications provided on Drawings.

2.8 PIPE OUTLETS

A. Head Walls: Precast reinforced concrete in accordance with NCDOT Standard 838.80.

B. Spillway Filter: Refer to installation procedures specified in Division 33 Section “Subdrainage”.
1. Stone to be fine aggregate, natural, or manufactured sand meeting the requirements of ASTM C33.
2. Collector Pipe shall be smooth wall, schedule 80 PVC, 4-inch nominal diameter with minimum 0.25-inch diameter perforations.
3. Cleanout and Outlet Pipes shall be smooth wall, schedule 80 PVC, 4-inch nominal diameter, solid.
4. Provide elbows, connections, fittings, etc. for piping as required furnished by pipe manufacturer for type of pipe used.

C. Energy Dissipaters: Refer to Drawings for shape and sizing; Design in accordance with NC Erosion and Sediment Control Planning and Design Manual.

PART 3 - EXECUTION

3.1 EARTHWORK

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

3.2 PIPING APPLICATIONS

A. Gravity-Flow, Nonpressure Piping: Use the following pipe materials for each size range:
1. NPS 4 to NPS 6: Ductile-iron culvert pipe, ductile-iron standard or compact fittings, gaskets, and gasketed joints.
2. NPS 4 and NPS 6: PVC pipe and fittings, gaskets, and gasketed joints.
3. NPS 8 to NPS 12: Ductile-iron culvert pipe, ductile-iron standard or compact fittings, gaskets, and gasketed joints.
4. NPS 18 to NPS 36: Reinforced-concrete pipe and fittings, gaskets, and gasketed joints.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of storm piping. Location and arrangement of piping layout take design

considerations into account. 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 proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. Install spillway filter and toe drain per direction of Geotechnical Engineer and Plans.

E. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at the specified slope as noted on Plans.
2. Install piping with 12-inch minimum cover.
3. Install piping below frost line.
4. Install ductile-iron culvert piping according to ASTM A 716.
5. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.
6. Install PVC piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
2. Join PVC piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
    a. Joints shall be wrapped with a double layer of non-woven geotextile fabric (Mirafi 180N or approved equivalent) in 2-foot wide strips centered on joints.
4. Join dissimilar pipe materials with nonpressure-type flexible[**or rigid**] couplings.

3.5 STORMWATER OUTLET INSTALLATION

A. Construct inlet head walls, as indicated.

B. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

C. Construct energy dissipaters at outlets, as indicated.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

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.

1. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Crushed, broken, cracked, or otherwise damaged piping.
    c. Infiltration: Water leakage into piping.
    d. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

3.8 CLEANING

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

END OF SECTION 334100

ECS Southeast, LLC

Geotechnical Engineering Report

Academy Complex Renovations

Concord, Cabarrus County, North Carolina

ECS Project No. 08:15911

July 15, 2024

ECS SOUTHEAST, LLC
NC Engineering License No. F-1519
Geotechnical • Construction Materials • Environmental • Facilities

July 15, 2024

Mr. Dan Dodd, RLA
FitFields
314 Tom Hall Street
Fort Mill, South Carolina 29715

ECS Project No. 08:15911

Reference: Geotechnical Engineering Report
Academy Complex Renovations
Concord, Cabarrus County, North Carolina

Dear Mr. Dodd,

ECS Southeast, LLC (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering recommendations for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to you during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design and construction phase to confirm subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us at (704) 525-5152.

Respectfully submitted,

ECS Southeast, LLC

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APPENDICES

EXECUTIVE SUMMARY

The below information summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

This report contains the results of our subsurface exploration and geotechnical engineering recommendations for the proposed Academy Complex Renovations located in Concord, Cabarrus County, North Carolina.

- Existing fill was encountered at 4 of the 5 boring locations and extending to depths ranging approximately 3 to 5 ½ feet below existing grades. Records of the fill placement were not provided to us; therefore, the fill is considered undocumented. ECS does not recommend supporting building foundations or slabs on existing undocumented fill. The risk associated with undocumented fill can be reduced by removal and replacement with Engineered Fill. Existing fill free of organic and/or deleterious materials can be re-used (i.e. removed and reworked in controlled lifts) provided it meets the requirements for Engineered Fill.

- Lower consistency soils with an N-value of 6 bpf or less, were encountered at 3 of the 5 boring locations and extended to depths ranging from approximately 5 ½ to 10 feet below existing grades. Depending on final site grades, existing fill remediation procedures, and construction phase testing (i.e., proofrolling, DCP testing), lower consistency/loose soils may require undercutting, moisture conditioning, and/or compaction prior to fill placement or construction of slabs or foundations.

- Partially Weathered Rock (PWR) was encountered at 3 of the 5 boring locations beginning at depths ranging from approximately 3 to 12 feet below existing grades. Additionally, auger refusal (i.e. possible rock) was encountered at Boring B-03 at a depth of approximately 6.8 feet below existing grade.

- Based on the results of subsurface exploration, the proposed structure can be supported on conventional shallow foundations bearing on low plasticity residual soils, newly placed Engineered Fill or reworked existing fill using a net allowable bearing pressure of 2,500 psf.

- Based on the SPT N-value method, a Seismic Site Class “D” is appropriate for the structure.

1.0 INTRODUCTION

The purpose of this study was to provide subsurface exploration and geotechnical recommendations for the proposed Academy Complex Renovations located at 165 Academy Avenue NW in Concord, Cabarrus County, North Carolina. The recommendations developed for this report are based on the project information supplied by the Client. Our services were provided in accordance with ECS Proposal No. 08:30313PP dated June 7, 2024, and includes the Terms and Conditions of Service outlined within the agreement.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the geotechnical aspects of the project. The report includes the following items.

- Information on current site conditions, including geologic information and special site features.
- Description of the field exploration and laboratory tests performed.
- Final logs of the soil borings and records of the field exploration and laboratory tests performed.
- Measurement of the surficial materials at each boring location.
- Recommendations regarding foundations options and settlement potential for the structure.
- Recommendations regarding slab-on-grade construction and design.
- Seismic site classification per North Carolina Building Code based on average N-value method.
- Evaluation of the on-site soil characteristics encountered in the soil borings with respect to the suitability of the on-site materials for reuse as Engineered Fill.
- Recommendations for minimum soil cover during frost heaving, compaction requirements for fill and backfill areas, and slab-on-grade construction.
- Recommendations regarding site preparation and construction observations and testing.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The project site is located 165 Academy Avenue NW in Concord, Cabarrus County, North Carolina as shown on the figure below and included on the Site Location Diagram in Appendix A. According to Cabarrus County GIS, the site is a portion of the 8.447-acre parcel identified as Cabarrus County Parcel ID Number (PIN) 56206805220000.

Based on our site reconnaissance, the site is currently occupied by an athletic field with associated ancillary structures and gravel drive/walkway areas. The site is bordered by Academy Avenue NW to the northwest, school and community buildings and athletic fields to the northeast/east, single family homes to the south, and commercial buildings to the west. Based on the client provided topographic information, existing site grade elevations range from approximately 632 to 640 feet, generally sloping up from west to east.

Based on a review of available historic imagery, as early as 1956, it appears that the site was vacant, cleared, and graded with surrounding development. By 1965, it appears that the site was developed with an athletic field and various associated structures. Since that time, the site has remained in a similar condition with the additional structures added. The previous use of discussion is not considered a comprehensive or in-depth of the site history, rather a quick overview of available aerial imagery.

2.2 PROPOSED CONSTRUCTION

ECS understands that the proposed renovations will include the construction of a new 1-story restroom structure and artificial turf sports fields. Structural loading and site grading plans were not provided to us at the time of the report. For the purpose of this report, we have assumed maximum cut and fill depths in the range of 2 feet or less from existing grades. The following information provides our understanding of the planned structure.

PROJECT UNDERSTANDING	
SUBJECT	**DESIGN INFORMATION / ASSUMPTIONS (1)**
Usage	Restroom Facility
Number of Stories	One-story
Framing	Masonry and/or Wood
Column Loads	50 kips maximum
Wall Loads	3 kips per linear foot (klf) maximum

Notes:
(1) If any of these assumptions are incorrect, we ask the ECS be notified in order to reassess and update our recommendations, if necessary.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedure. Our scope of work included drilling five (5) soil test borings to depths ranging from approximately 6.8 to 18.8 feet below existing grades. The borings were located using GPS technology and existing site features as reference and their approximate locations are shown on the Boring Location Diagram in Appendix A. The topographic data and elevations noted on the Boring Logs, Subsurface Cross Sections, and referenced in this report were estimated from the client provided topographic information and should be considered approximate.

3.1 SUBSURFACE CHARACTERIZATION

The site is located in the Piedmont Physiographic Province of North Carolina. The native soils in the Piedmont Province consist mainly of residuum with underlying saprolites weathered from the parent bedrock, which can be found in both weathered and unweathered states. In a mature weathering profile of the Piedmont Province, the soils are generally found to be finer grained at the surface where more

extensive weathering has occurred. The particle size of the soils generally becomes more granular with increasing depth and gradually changes first to weathered and finally to unweathered parent bedrock.

The natural geology within the site has been modified in the past by grading, disturbance of near-surface soils, and/or placement of fill materials. The quality of man-made fills can vary significantly, and it is difficult to assess the engineering properties of existing fills. Furthermore, there is no specific correlation between N-values from standard penetration tests performed in soil test borings and the degree of compaction of existing fill soils; however, a qualitative assessment of existing fills can sometimes be made based on the N-values obtained and observations of the materials sampled in the test borings.

The following sections provide generalized characterizations of the subsurface materials. Please refer to the subsurface cross sections in Appendix A and boring logs in Appendix B for more detailed information.

GENERALIZED SUBSURFACE CONDITIONS			
Approximate Depth (ft)	**Stratum**	**Description**	**Ranges of SPT(1) N-values (bpf)**
0 to 0.4	N/A	Surficial gravel and organic laden soils (2)	N/A
0.2 to 5.5	I	FILL – Sandy Lean CLAY (CL), Clayey SAND (SC), and Silty SAND (SM) (3)	1 to 14
0.3 to 12	II	RESIDUUM – Lean CLAY/Sandy Lean CLAY (CL), Clayey SAND (SC), and Silty SAND (SM)	6 to 32
3 to 18.8	III	PARTIALLY WEATHERED ROCK (PWR)(4)(5) – Sampled as Silty SAND	50/2" to 50/5"

Notes:
(1) Standard Penetration Testing in blows per foot (bpf).
(2) Surficial materials are driller reported and should not be used for material takeoffs.
(3) Existing fill was encountered at 3 of the 5 boring locations and extended to a depths ranging from approximately 3 to 5 ½ feet below the existing ground surface.
(4) Partially Weathered Rock (PWR) was encountered at 3 of the 5 boring locations beginning at depths ranging from approximately 3 to 12 feet below existing grades.
(5) Auger refusal (i.e. possible rock) was encountered at Boring B-03 at a depth of approximately 6.8 feet below existing grade.

3.2 GROUNDWATER OBSERVATIONS

Groundwater measurements were attempted at the termination of drilling and prior to demobilization from the site. Groundwater was encountered at Borings B-01, B-02, and B-04 at depths of approximately 9.3, 9.4 feet, and 8 feet below ground surface at the time of drilling, respectively. Groundwater was not apparent within the remaining borings at the time of drilling to the explored depths. Cave in depths were measured at each of the boring locations and ranged from approximately 4.2 to 13.8 feet below existing grades. Cave-in of a soil test boring can be caused by groundwater hydrostatic pressure, weak soil layers, and/or drilling activities. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

3.3 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration. Classification, moisture content, percent fines (-200 wash), and Atterberg limit tests were performed. The results are included on the boring logs in Appendix B and Laboratory Testing Summary in Appendix C.

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols, and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System, USCS). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

4.0 DESIGN RECOMMENDATIONS

4.1 FOUNDATIONS

Provided existing undocumented fill is remediated, and subgrades and Engineered Fill are prepared as recommended in this report, the proposed structure can be supported by conventional shallow foundation systems bearing on low plasticity residual soils, newly-placed Engineered Fill and/or approved reworked existing fill. Alternatively, foundations may be extended through the existing fill to bear on residual soils, provided the Owner is willing to accept the risk of supporting slab on undocumented fill. We recommend the foundation design use the following parameters:

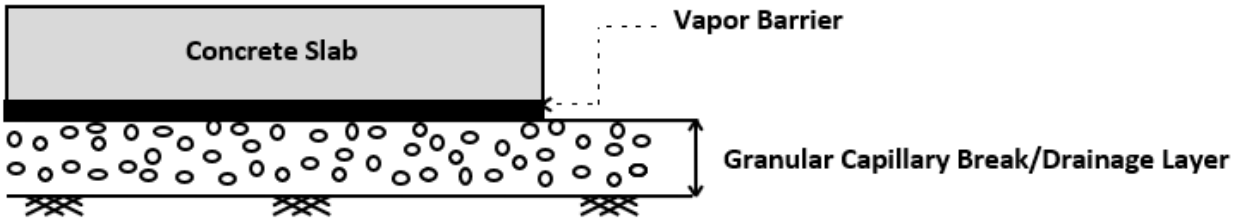
FOUNDATION RECOMMENDATIONS		
Design Parameter	**Column Footing**	**Wall Footing**
Net Allowable Bearing Pressure (1)	2,500 psf (2)	
Acceptable Bearing Soil Material	Low Plasticity Residual Soils, Newly-Placed Engineered Fill, and/or Reworked Existing Fill	
Minimum Width	24 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade) (3)	18 inches	18 inches
Minimum Exterior Frost Depth (below final exterior grade)	12 inches	12 inches
Estimated Total Settlement (4)	1 inch or less	1 inch or less
Estimated Differential Settlement (5)	½ inch or less	½ inch or less

Notes:
(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) Following remediation of existing fill.
(3) For bearing considerations.
(4) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
(5) Based on assumed maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

Potential Undercuts: Following remediation of existing undocumented fill and lower consistency soils, we anticipate the majority of the materials at the foundation bearing elevation should be acceptable for support of the proposed structure. If soft or unsuitable soils are observed at the footing bearing elevations at the time of footing construction, the unsuitable soils should be removed and replaced. Undercut areas should be backfilled with lean concrete ($f'_c \geq 1{,}000$ psi at 28 days) or compacted crushed aggregate up to the original design bottom of footing elevation.

4.2 SLABS ON GRADE

Provided existing undocumented fill and lower consistency soils are remediated, are remediated, and subgrades and Engineered Fill are prepared as outlined in this report , the proposed floor slabs can be constructed as Ground Supported Slabs (or Slab-On-Grade) bearing on low-plasticity residual soils, newly placed Engineered Fill, and/or reworked existing fill. The following graphic depicts our soil-supported slab recommendations:



1. Drainage Layer Thickness: 4 inches, minimum
2. Drainage Layer Material: GRAVEL (GP, GW), SAND (SP, SW)
3. Subgrade compacted to **100%** maximum dry density per ASTM D698

Soft, yielding, and/or lower consistency soils may be encountered in some areas. Those soils should be properly moisture conditioned and compacted or removed and replaced with compacted Engineered Fill in accordance with the recommendations included in this report.

Subgrade Modulus: Provided the Engineered Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 90 pci (lbs per cubic inch). The modulus of subgrade reaction value is estimated based on a 1 foot by 1 foot plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the Structural Engineer and/or the Architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab such as in a turn down footing/monolithic slab configuration, the slab should be designed with appropriate reinforcement and load transfer devices (if necessary) to preclude overstressing of the slab.

4.3 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The North Carolina Building Code (NCBC) requires site classification for seismic design based on the upper 100 feet of a soil profile. The Standard Penetration Resistance (N-value) method was used in classifying this site. The seismic site class definitions for the weighted average of SPT N-values in the upper 100 feet of the soil profile are shown in the following table:

SEISMIC SITE CLASSIFICATION		
Site Class	**Soil Profile Name**	**$\bar{N}$ value (bpf)**
A	Hard Rock	N/A
B	Rock	N/A
C	Very Dense Soil and Soft Rock	>50
D	Stiff Soil Profile	15 to 50
E	Soft Soil Profile	<15

Based upon our subsurface findings, a Seismic Site Class of "**D**" is appropriate for the structure.

4.4 ARTIFICIAL TURF SPORTS FIELD

ECS has not been provided information regarding planned artificial turf playing surfaces. Subgrade preparation and fill material placement within the vicinity of the playing surface should conform to the field manufacturers specifications. Please note that the recommendations provided above address only general site grading operations and do not address fill material and placement specifications for the manufacturer's specifications.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of demolition and removal of existing structures, stripping vegetation, rootmat, topsoil, gravels and soft or unsuitable materials from the 10-foot expanded building limits, and 5 feet beyond the toe of Engineered Fills. Existing utilities, if present, should be abandoned and removed or grouted in place. ECS should be retained to observe that topsoil and unsuitable surficial materials have been removed prior to the placement of Engineered Fill or construction of structures.

5.1.2 Proofrolling

Prior to fill placement or other construction on building subgrades, the subgrades should be observed by ECS. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of ECS. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are unstable or "pumping" within the expanded building footprint, those areas should be repaired prior to the placement of any subsequent Engineered Fill or other construction materials. Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. The situation should be discussed with ECS to determine the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in determining the cause of the observed unstable materials, and to assist in selecting appropriate remedial actions to stabilize the subgrade.

5.2 EARTHWORK OPERATIONS

5.2.1 Existing Fill

Existing fill was encountered at each boring location except Boring B-03 and extended to depths ranging from approximately 3 to 5 ½ feet below existing grades. Records of the fill placement were not provided

to us; therefore, the fill is considered undocumented. Constructing over undocumented fill inherently creates a greater than normal risk that there could be excessive settlement of the supported structure. Existing fill devoid of deleterious materials and meeting the requirements of Engineered Fill may be re-used following undercutting/excavation. If available, records of the previous sitework (i.e. proofrolling, compaction testing, etc.) should be obtained and provided to us for review and updates to our recommendations, if warranted.

Undocumented fill poses risks associated with undetected deleterious inclusions within the fill and/or deleterious materials at the virgin ground/fill interface that are covered by the fill. Deleterious materials can consist of significant amounts of organics derived from organic rich strippings, rubbish, construction or demolition debris, shot rock, stumps and roots and logs. If these materials are covered over by or are within undocumented fill, the organic materials tend to decompose slowly in the anaerobic conditions in or under the fill. Decomposition can occur over periods ranging from several years to several decades. As the organic materials decompose, a void is created which can create soft conditions and even subsidence in areas above the organics. Additionally, nested debris or rock materials may contain voids and result in ground subsidence. Where these types of conditions exist under or within undocumented fill, they are sometimes in discreet pockets that can go undetected by normal subsurface exploration techniques, i.e. soil test borings and test pits.

Structures: ECS does not recommend supporting foundations and slabs on existing undocumented fill. The risks associated with undocumented fill can be reduced by full depth removal and replacement with Engineered Fill. Alternatively, foundations may be extend through the existing fill to bear on residual soils, provided the Owner is willing to accept the risk of supporting slabs on undocumented fill. Existing fill free of organic and/or other deleterious materials can be re-used (i.e. removed and reworked in controlled lifts) provided it meets the requirements for Engineered Fill.

5.2.2 Below Grade Excavation

Based on the results of the soil test borings, Partially Weathered Rock (PWR) was encountered at Boring B-01, B-02, and B-03 at beginning depths ranging from approximately 3 to 12 feet below existing grades. Additionally , auger refusal was entered at Boring B-03 at a depth of approximately 6.8 feet below existing grade. Based on the assumed proposed grades (i.e maximum cut depths of approximately 2 feet or less), we generally do not anticipate difficult excavation as the results of PWR/rock materials will be encountered during mass grading or building foundations excavation. However, depending on utility and drainage system depths, difficult excavation may be encountered. As noted in the Subsurface Characterization section of this report, the weathering process in the Piedmont can be erratic and significant depth variations of denser materials can occur in relatively short distances. In some cases, isolated boulders or rock seams may be present in the soil matrix.

5.2.3 Lower Consistency Soils

Lower consistency soils with an N-value of 6 bpf or less, were encountered at Borings B-01, B-02, and B-04 and extended to depths ranging from approximately 5 ½ to 10 feet below existing grades. Depending on final site grades, existing fill remediation, and construction phase testing (i.e. proofrolling and Dynamic Cone Penetrometer testing), lower consistency/loose soils may require selective undercutting, moisture conditioning, and/or compaction prior to fill placement or construction of the structure.

5.2.4 Engineered Fill

Prior to placement of Engineered Fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Engineered Fill Materials: Materials for use as Engineered Fill should consist of inorganic soils classified as CL, ML, SM, SC, SW, SP, GM, or GC, or a combination of these group symbols, per ASTM D2487. These materials should be free of organic matter, debris, and should contain no particle sizes greater than 4 inches in the largest diameter. Open graded materials and gravels (GW and GP), which contain void space in their mass, should not be used in Engineered Fills unless properly encapsulated with filter fabric. Engineered Fill material should have the index properties in the tables below:

ENGINEERED FILL INDEX PROPERTIES	
Subject	**Property**
Building Areas	LL < 50, PI < 30
Maximum Particle Size	4 inches
Maximum Organic Content	5% by dry weight
Minimum Dry Unit Weight (ASTM D698)	90 pounds per cubic foot

ENGINEERED FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction (greater than 24 inches below finished soil subgrade)	95% of Maximum Dry Density
Required Compaction (within 24 inches of finished soil subgrade)	100% of Maximum Dry Density
Moisture Content	-3 to +3 % of the soil's optimum value
Loose Thickness (maximum) (1)	8 inches prior to compaction

(1) Thinner lifts may be required depending on compaction equipment utilized.

Unsatisfactory Materials: Unsatisfactory fill materials include materials which do not satisfy the requirements for Engineered Fill, as well as topsoil and organic materials (OH, OL), Elastic SILT (MH), Fat CLAY (CH), and materials with a maximum dry density of less than 90 pcf per ASTM D698.

On-Site Borrow Suitability: Soils that meet the definition of Engineered Fill are present on the site including soils classified as Lean CLAY (CL), Clayey SAND (SC), and Silty SAND (SM); however, moisture conditioning (i.e. wetting and/or drying) should be anticipated. Excavated Partially Weathered Rock (PWR) may require processing (i.e. crushing and/or screening) to use as site Engineered Fill depending on the resulting rock fragment size (i.e. greater than 4 inches nominal diameter) and ability of compaction equipment to break down the PWR materials; similarly, rock materials could be processed on-site for re-use as Engineered Fill.

Fill Placement: Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of Engineered Fill or other fill and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned. Where fill materials will be placed to widen existing embankment fills, or placed up against sloping ground, the soil subgrade should be scarified, and the new fill benched or keyed into the existing material. Fill material should be placed in horizontal lifts.

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. Filling operations should be observed on a full-time basis by ECS to determine that the minimum compaction requirements are being achieved.

Compaction Equipment: Compaction equipment appropriate for the soil type being compacted should be used to compact the subgrades and fill materials. Sheepsfoot compaction equipment should be used for fine-grained soils (Clays and Silts). A vibratory steel drum roller should be used for compaction of coarse-grained soils (Sands) as well as for sealing compacted surfaces.

5.2.5 General Construction Considerations

Because the site has been previously disturbed, built-over, and/or filled, we emphasize the importance of comprehensive subgrade evaluations prior to Engineered Fill placement and/or other construction activities. These evaluations may include proofrolling the subgrade soils, performing hand auger borings, and excavation of test pits within previously disturbed, built-over, and/or filled areas. The mentioned evaluations would help in identifying areas of soft, loose, otherwise unsuitable materials, or buried debris, which would require remedial activities. We recommend a contingency for unforeseen conditions in the earthwork phase of construction.

Moisture Conditioning: During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to prevent construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and used as Engineered Fill provided it meets project specifications.

Surface Drainage: Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of at least 1 percent to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each workday, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to minimize infiltration of surface water.

Excavation Safety: Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The Contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The Contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the Contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our Client. ECS is not assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the foundation bearing level. Therefore, foundation concrete should be placed the same day that excavations are made, and the bearing capacity has been verified. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 2 to 3-inch thick "mud mat" of "lean" concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: Following remediation lower consistency soils, if necessary, most of the soils at the foundation bearing elevations are anticipated to be acceptable for support of the proposed structure. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

Slab Subgrade Observations: Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in Section 5.1.2 Proofrolling.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally acceptable for support of utility pipes. PWR and/or rock materials encountered at utility subgrade excavations should be undercut an additional 6-inches and replaced with bedding material to reduce potential point load stress. The pipe subgrades should be observed and probed for stability by ECS. Loose or unsuitable materials encountered should be removed and replaced with compacted Engineered Fill, or pipe stone bedding material.

Utility Backfilling: Granular bedding material should be at least 4 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for Engineered Fill and Fill Placement.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by the Client. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

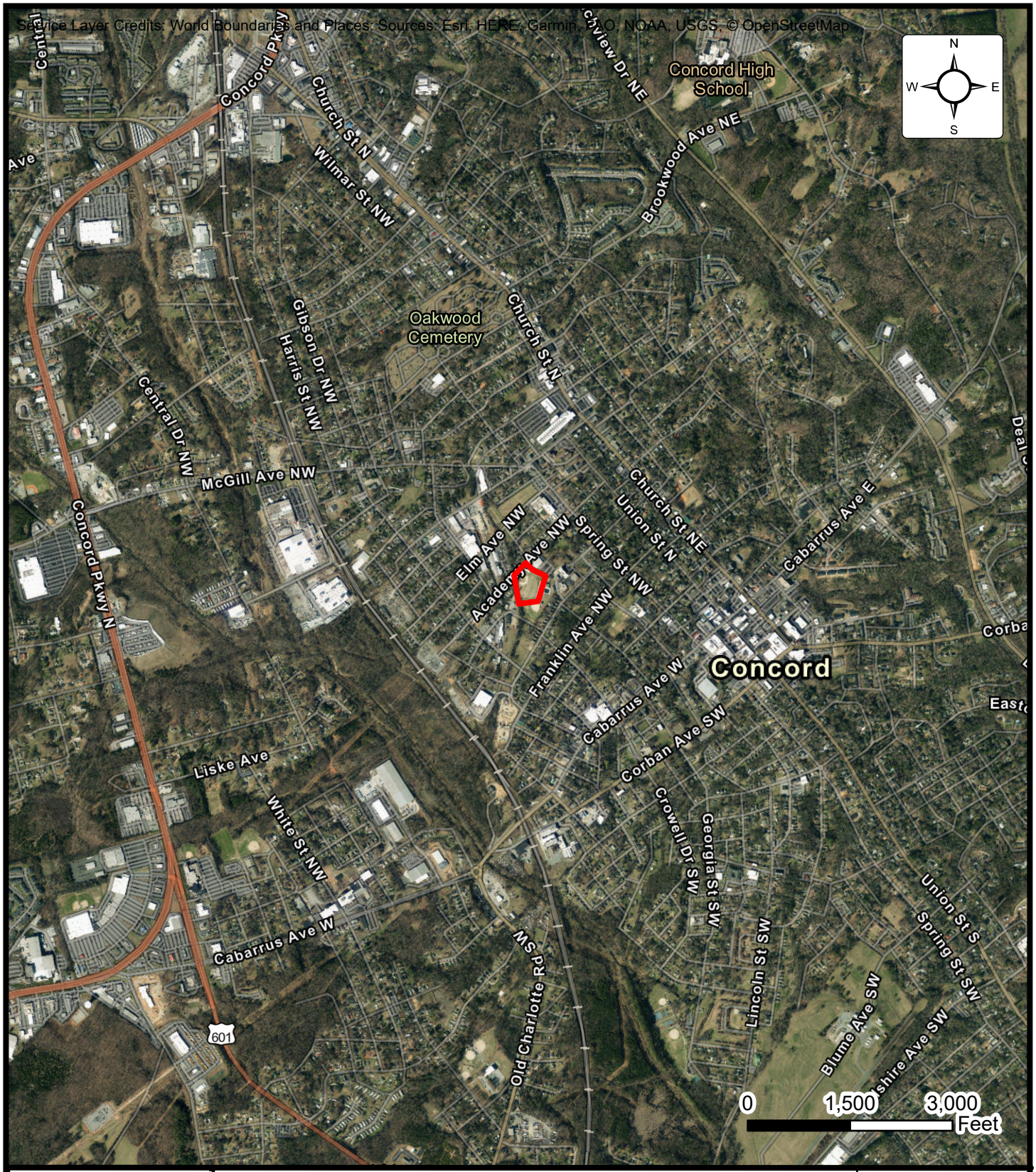
We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. ECS should be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendations should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

Appendix A - Drawings and Reports

Site Location Diagram
Boring Location Diagram(s)
Subsurface Cross-Section(s)

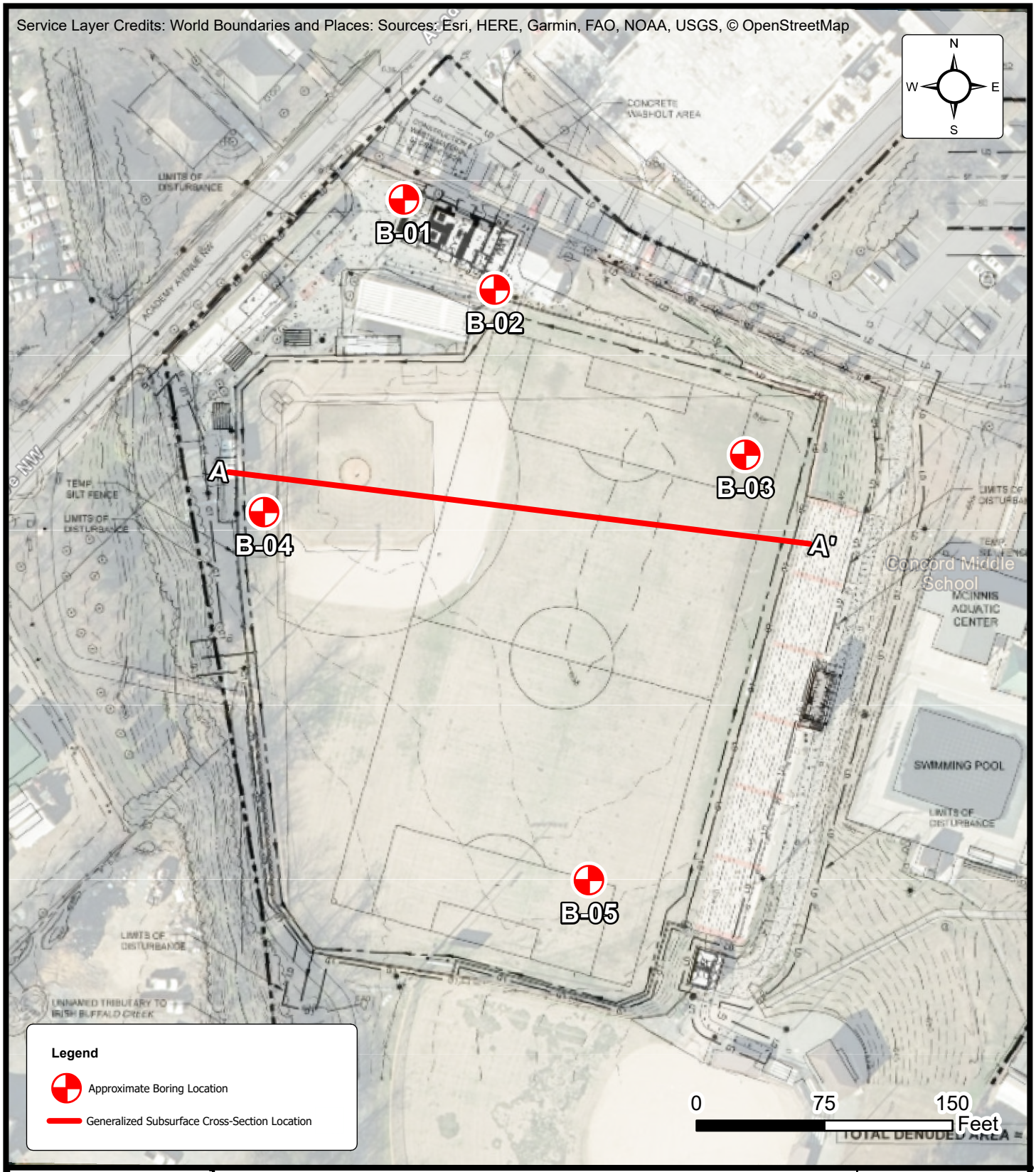


SITE LOCATION DIAGRAM
Academy Complex Renovations

Concord, Cabarrus County, North Carolina

FitFields

ENGINEER	CJC
SCALE	AS NOTED
PROJECT NO.	08:15911
FIGURE	1
DATE	7/15/2024

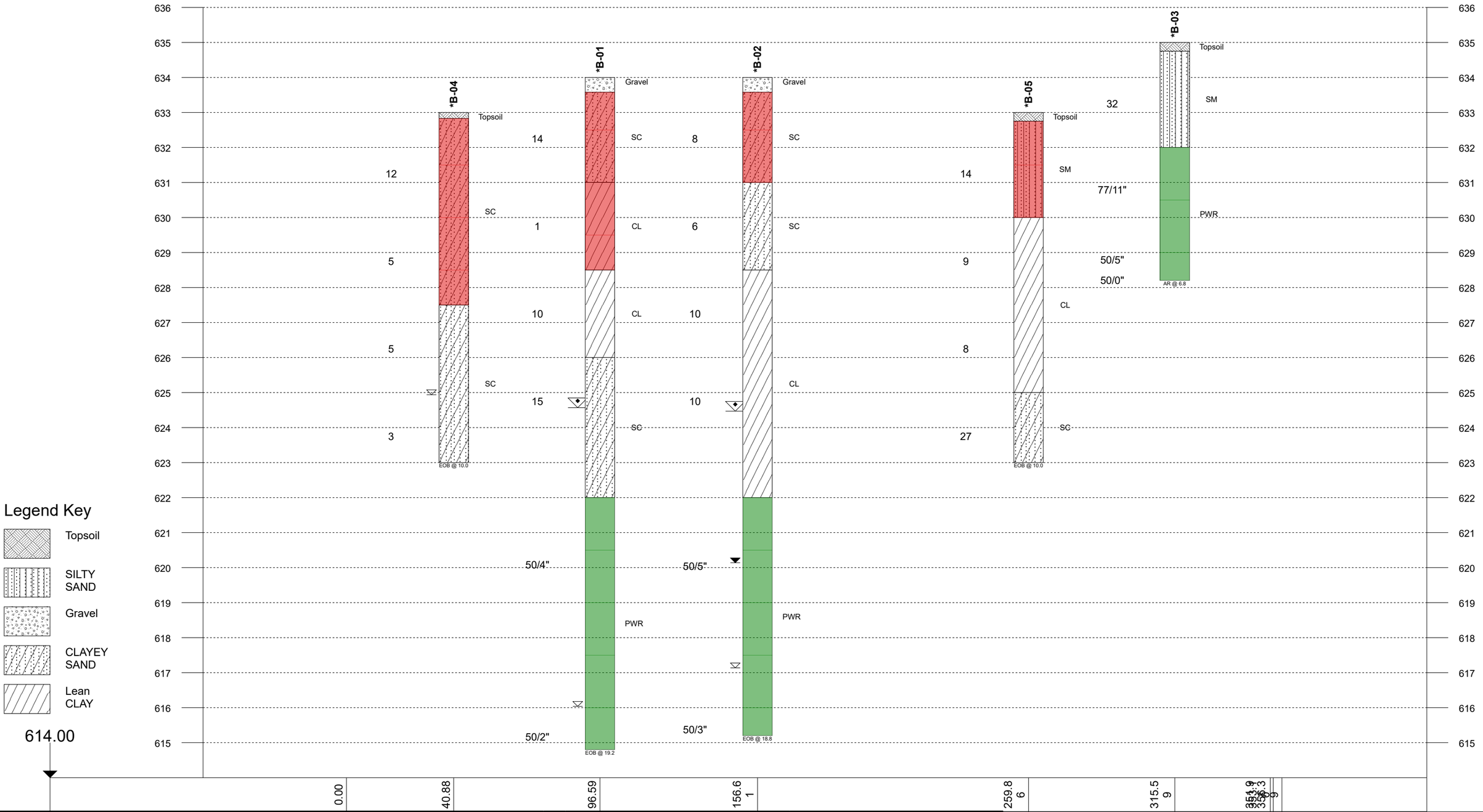


BORING LOCATION DIAGRAM
Academy Complex Renovations

Concord, Cabarrus County, North Carolina

FitFields

ENGINEER	CJC
SCALE	AS NOTED
PROJECT NO.	08:15911
FIGURE	2
DATE	7/15/2024



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit X—●—△	WL (First Encountered)		Fill
[FINES CONTENT %]	WL (Completion)		Possible Fill
BOTTOM OF CASING	WL (Estimated Seasonal High Water)		Probable Fill
LOSS OF CIRCULATION	WL (Stabilized)		Rock
CALIBRATED PENETROMETER			

GENERALIZED SUBSURFACE CROSS SECTION

A-A'

Academy Complex Renovations

FitFields

Concord, Cabarrus County, North Carolina

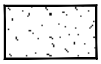
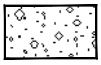
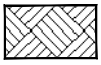
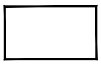
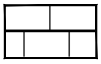
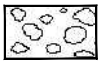
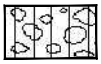
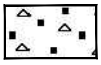
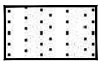
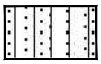
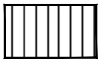
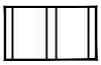
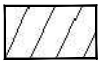
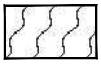
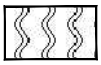
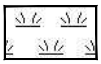
Project No: 08:15911 Date: 07/15/2024

Appendix B – Field Operations

Reference Notes
Exploration Procedures
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

		ASPHALT
		CONCRETE
		GRAVEL
		TOPSOIL
		VOID
		BRICK
		AGGREGATE BASE COURSE
	GW	WELL-GRADED GRAVEL gravel-sand mixtures, little or no fines
	GP	POORLY-GRADED GRAVEL gravel-sand mixtures, little or no fines
	GM	SILTY GRAVEL gravel-sand-silt mixtures
	GC	CLAYEY GRAVEL gravel-sand-clay mixtures
	SW	WELL-GRADED SAND gravelly sand, little or no fines
	SP	POORLY-GRADED SAND gravelly sand, little or no fines
	SM	SILTY SAND sand-silt mixtures
	SC	CLAYEY SAND sand-clay mixtures
	ML	SILT non-plastic to medium plasticity
	MH	ELASTIC SILT high plasticity
	CL	LEAN CLAY low to medium plasticity
	CH	FAT CLAY high plasticity
	OL	ORGANIC SILT or CLAY non-plastic to low plasticity
	OH	ORGANIC SILT or CLAY high plasticity
	PT	PEAT highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

WATER LEVELS[6]

- WL (First Encountered)
- WL (Completion)
- WL (Seasonal High Water)
- WL (Stabilized)

FILL AND ROCK

FILL | POSSIBLE FILL | PROBABLE FILL | ROCK

[1]Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2]To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3]Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4]Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5]Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6]The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7]Minor deviation from ASTM D 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)

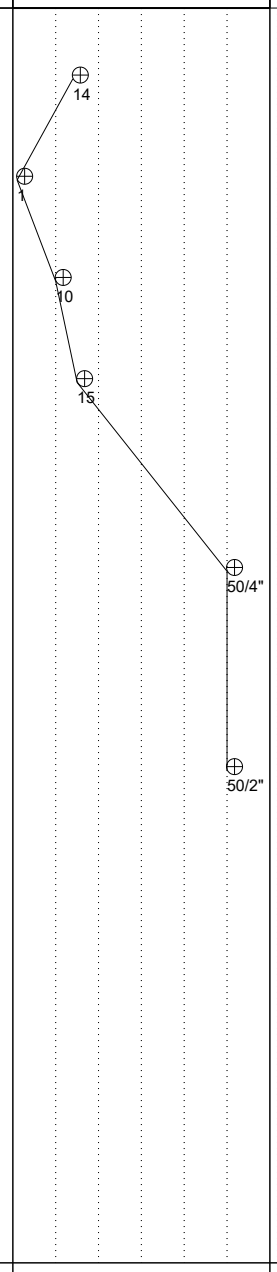
- Auger is advanced* and an additional SPT is performed
- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.

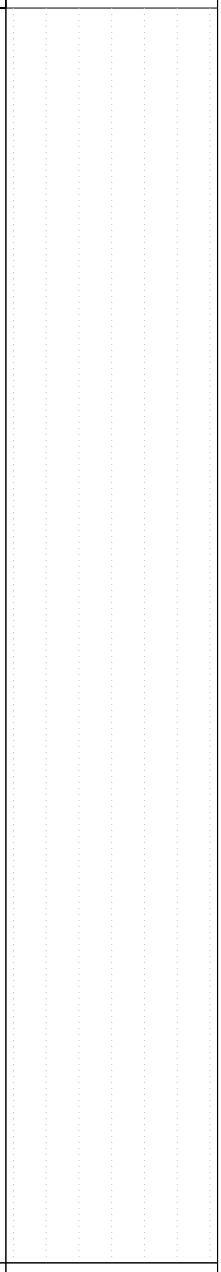
**Drilling Methods May Vary*— The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
FitFields	**08:15911**	**B-01**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Academy Complex Renovations	**M & M Drilling**		
SITE LOCATION:			LOSS OF CIRCULATION
Concord, Cabarrus County, North Carolina			
LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
35.412492	**-80.591368**		**634.0**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
					Gravel Thickness[5"]			
	S-1	SS	18	18	(SC FILL) FILL, CLAYEY SAND, reddish brown, moist			5-8-6 (14)
	S-2	SS	18	18	(CL FILL) FILL, SANDY LEAN CLAY, reddish brown, moist			1-WOH-1 (1)
5	S-3	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, gray and light reddish brown, moist, stiff		629	2-4-6 (10)
	S-4	SS	18	18	(SC) CLAYEY SAND, gray, moist, medium dense	▽		3-6-9 (15)
10							624	
	S-5	SS	10	10	(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, gray and brown, moist			29-50/4" (50/4")
15							619	
	S-6	SS	8	8		▽		43-50/2" (50/2")
20					**END OF BORING AT 19.2 FT**		614	
25							609	
30							604	





THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**17.90**	BORING STARTED:	**Jul 02 2024**	CAVE IN DEPTH:	**13.00**
▼ WL (Completion)	**GNE**	BORING COMPLETED:	**Jul 02 2024**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	**Hollow Stem Auger**
▽ WL (Stabilized)	**9.30**	**Mobile B57**	**JPR2**		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
FitFields	**08:15911**	**B-02**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Academy Complex Renovations	**M & M Drilling**

SITE LOCATION: **Concord, Cabarrus County, North Carolina**

LOSS OF CIRCULATION

LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
35.412349	**-80.591186**		**634.0**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
					Gravel Thickness[5"]		
	S-1	SS	18	18	(SC FILL) FILL, CLAYEY SAND, brownish red, moist		4-5-3 (8)
	S-2	SS	18	18	(SC) Residuum, CLAYEY SAND, yellowish red, moist, loose		2-3-3 (6)
5						629	
	S-3	SS	18	18	(CL) SANDY LEAN CLAY, gray, moist, stiff		2-4-6 (10)
	S-4	SS	18	18			4-5-5 (10)
10						624	
	S-5	SS	11	11	(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, reddish brown to gray, moist		10-50/5" (50/5")
15						619	
	S-6	SS	3	3			50/3" (50/3")
					END OF BORING AT 18.8 FT		
20						614	
25						609	
30						604	

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50 | 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT: 10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %: 10 20 30 40 50

8
6
10
10
50/5"
50/3"
18
22.6
38
[48.5%]

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**16.80**	BORING STARTED:	**Jul 02 2024**	CAVE IN DEPTH:	**13.80**
WL (Completion)	**13.80**	BORING COMPLETED:	**Jul 02 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT:	**Mobile B57**	LOGGED BY: **JPR2**	DRILLING METHOD: **Hollow Stem Auger**
WL (Stabilized)	**9.40**				

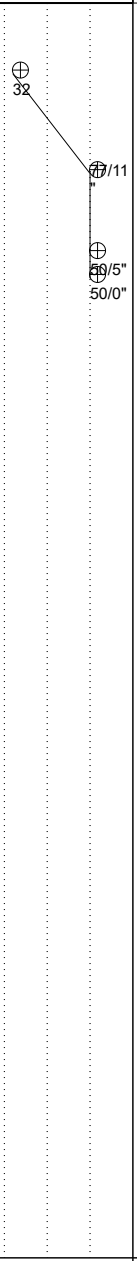
GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
FitFields	**08:15911**	**B-03**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
Academy Complex Renovations	**M & M Drilling**		
SITE LOCATION:			LOSS OF CIRCULATION
Concord, Cabarrus County, North Carolina			
LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
35.412090	**-80.590688**		**635.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
					Topsoil Thickness[3"]			
	S-1	SS	18	18	(SM) Residuum, SILTY SAND, white and light brown, moist, dense			8-18-14 (32)
	S-2	SS	17	17	(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, brownish red and white, moist			14-27-50/5" (77/11")
5	S-3	SS	5	5			630	50/5" (50/5")
	S-4	SS	0	0	**AUGER REFUSAL AT 6.8 FT**			50/0" (50/0")
10							625	
15							620	
20							615	
25							610	
30							605	

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50
20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT
10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF
1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**GNE**	BORING STARTED:	**Jul 02 2024**	CAVE IN DEPTH:	**4.20**
WL (Completion)	**GNE**	BORING COMPLETED:	**Jul 02 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT: **Mobile B57**	LOGGED BY: **JPR2**	DRILLING METHOD:	**Hollow Stem Auger**
WL (Stabilized)	**GNE**				

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
FitFields	**08:15911**	**B-04**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Academy Complex Renovations	**M & M Drilling**

SITE LOCATION: **Concord, Cabarrus County, North Carolina**

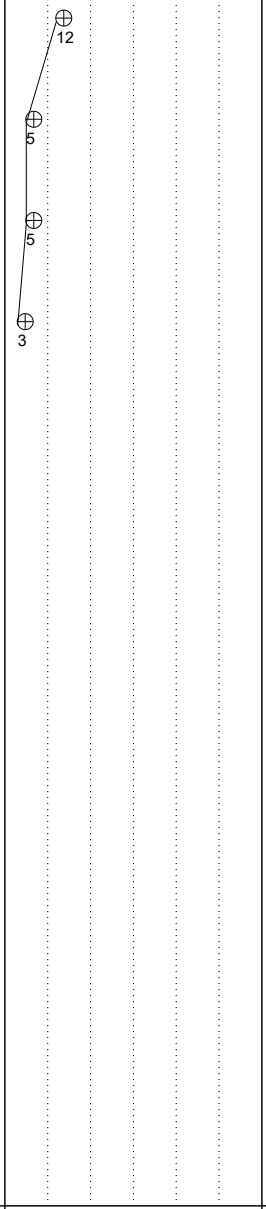
LOSS OF CIRCULATION

LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
35.411985	**-80.591633**		**633.0**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
					Topsoil Thickness[2"]			
	S-1	SS	18	18	(SC FILL) FILL, CLAYEY SAND, dark brown to light red, moist			7-6-6 (12)
	S-2	SS	18	18				2-2-3 (5)
5							628	
	S-3	SS	18	18	(SC) Residuum, CLAYEY SAND, gray and reddish brown, moist to wet, loose to very loose	▽		2-3-2 (5)
	S-4	SS	18	18				2-2-1 (3)
10					**END OF BORING AT 10.0 FT**		623	
15							618	
20							613	
25							608	
30							603	

STANDARD PENETRATION BLOWS/FT (10 20 30 40 50 / 20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT (10 20 30 40 50)
TEXAS CONE PENETRATION BLOWS/FT



LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] %
(10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**8.00**	BORING STARTED:	**Jul 02 2024**	CAVE IN DEPTH:	**6.40**
▼ WL (Completion)	**GNE**	BORING COMPLETED:	**Jul 02 2024**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **Mobile B57**	LOGGED BY: **JPR2**	DRILLING METHOD:	**Hollow Stem Auger**
▽ WL (Stabilized)	**GNE**				

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
FitFields	**08:15911**	**B-05**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Academy Complex Renovations	**M & M Drilling**

SITE LOCATION: **Concord, Cabarrus County, North Carolina**

LOSS OF CIRCULATION

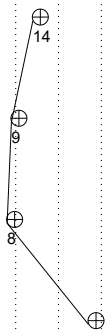
LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
35.411401	**-80.590982**		**633.0**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
					Topsoil Thickness[3"]			
	S-1	SS	18	18	(SM FILL) FILL, SILTY SAND, gray and brown, moist			7-7-7 (14)
	S-2	SS	18	18	(CL) Residuum, LEAN CLAY, reddish brown, moist, stiff to firm		628	2-4-5 (9)
5	S-3	SS	18	18				2-3-5 (8)
	S-4	SS	18	18	(SC) CLAYEY SAND, light brown, moist, medium dense		623	5-12-15 (27)
10					**END OF BORING AT 10.0 FT**			
15							618	
20							613	
25							608	
30							603	

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50
20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
MC SAMPLER BLOWS/FT
10 20 30 40 50
TEXAS CONE PENETRATION BLOWS/FT

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF
1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	**GNE**	BORING STARTED:	**Jul 02 2024**	CAVE IN DEPTH:	**6.00**
WL (Completion)	**GNE**	BORING COMPLETED:	**Jul 02 2024**	HAMMER TYPE:	**Auto**
WL (Seasonal High Water)		EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	**Hollow Stem Auger**
WL (Stabilized)	**GNE**	**Mobile B57**	**JPR2**		

GEOTECHNICAL BOREHOLE LOG

Appendix C – Laboratory Testing

Laboratory Testing Summary

Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-02	S-2	3.5-5.0	22.6	*SC	38	18	20	48.5					

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Academy Complex Renovations
Client: FitFields

Project No.: 08:15911
Date Reported: 7/15/2024

Office / Lab	Address	Office Number / Fax
ECS Southeast LLC - Charlotte	1812 Center Park Drive Suite D Charlotte, NC 28217	(704)525-5152 (704)357-0023

Appendix D – Other Information

GBA - Geotechnical Engineering Report Information Sheet

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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